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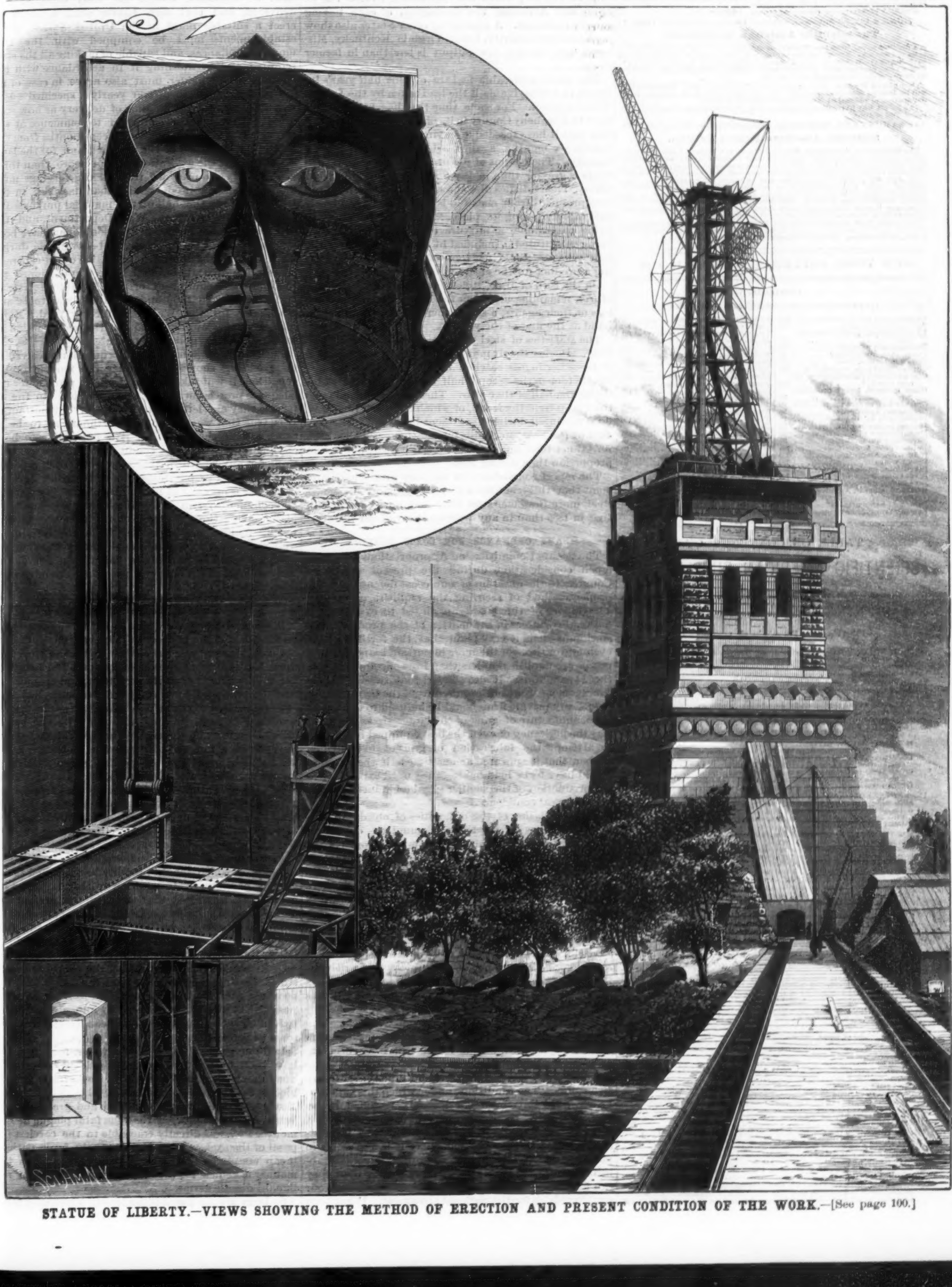

STATUE OF LIBERTY.—VIEWS SHOWING THE METHOD OF ERECTION AND PRESENT CONDITION OF THE WORK.—[See page 100.]

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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 554.

For the Week Ending August 14, 1886.

Price 10 cents. For sale by all newsdealers.

PRODUCTION OF IRON AND STEEL IN AMERICA.

The semi-annual statistical statement of the American Iron and Steel Association is of particular interest, as it shows an unprecedented activity in both of these industries. During the first six months of the year, the product of pig iron amounted to 2,954,209 tons of 2,000 pounds. In a similar period of time, the country has never before produced such a large amount of pig iron. Prior to 1879, indeed, the output for the whole year never reached these figures. During the first half of 1885, the product was 2,150,816 net tons, and during the latter half 2,379,053 net tons. The greatest absolute gain in production this year was made by Pennsylvania, but the greatest relative gain made by any of the important iron-producing States was in Ohio and Alabama, the production of each having largely increased. A number of other States also show a greater productivity, but in Virginia, Kentucky, Missouri, and Georgia, the output is less than in former years.

The most noticeable feature of this half year's increase in Pennsylvania is the lead taken by the Lehigh Valley district. For some time this has been second only to Allegheny County in its pig iron production, but this year it has exceeded it, having produced 320,568 net tons in six months, against 301,014 tons in Allegheny County. The output of pig iron in either of these districts is greater than in any State in the Union except Ohio. The statistics also show that the amount of pig iron produced from charcoal is on the decline, mineral fuel rapidly taking its place. Less anthracite, too, is being used alone, a mixture of anthracite and coke being substituted. Included in this aggregate for the half year are 22,446 net tons of spiegeleisen, indicating a product for the entire year of at least 50,000 tons.

On the 30th of June, 1886, there were 470,421 net tons of iron remaining unsold in the hands of the iron masters or their agents, a slight increase over the stock in hand at the first of the year.

The statistics of steel production show a similar activity. During the six months just past, the production of Bessemer ingots reached 1,073,663 net tons, against 938,418 tons in the second half of 1885 and 763,344 tons in the first half of that year. These figures include also the Clapp-Griffiths metal, of which 24,810 net tons have been produced during the present half year. The product of Bessemer steel rails during this period has been 707,447 net tons, an increase over last year, but less in proportion than during 1882.

The report concludes with the very gratifying statement that this country will produce more Bessemer steel, more Bessemer steel rails, and more open hearth steel in 1886 than in any previous year of our history.

HEAVY ORDNANCE FOR COAST DEFENSE.

The Senate Committee on Appropriations has given much consideration during the present session of Congress to the question of our coast defense and the proper method of securing the requisite armament. The report of the board appointed to examine the national resources in the matter of the production of steel guns made it very plain that the fortification of even two or three of the more important seaports could not be accomplished in less than from one and a half to three years' time. It also showed that substantial encouragement would be required from the Government, before any private firms could be induced to undertake the manufacture of guns of the larger sizes. So great was the hesitancy of even the best equipped iron works to attempt the fabrication of guns of over 12 inch caliber, that it appeared at one time as if the question would have to be held in abeyance until experience in the production of the smaller sizes had induced greater metallurgical confidence.

An appreciation of the difficulties of obtaining suitable arms has aroused the Committee on Coast Defenses to the necessity of prompt action. They have now secured, if not all possible, at least all requisite information, and are in a position to act advisedly in urging Congress to appropriate an adequate amount, and provide for its judicious expenditure. The propositions and amendments offered for the consideration of the Committee and the Senate have been very numerous. Many of these have naturally been ill advised. The fault in most cases has been a failure to recognize the importance of the subject and a disposition to put it off with very inadequate legislation. As finally revised, however, the Fortification bill has much to commend it, and deserves favorable consideration at the hands of both Houses of Congress. The appropriation is liberal compared to the meager sum originally proposed, but it could still have been increased to advantage. As passed by the Senate, the bill appropriates something over six millions for defensive works. The conditions under which this sum is to be expended have been considerably modified, in accordance with the suggestions of Senator Hawley. Even if there be no patriotic sentiment to prohibit such a course, it is now found that it is impossible to purchase guns of Krupp or any other foreign establishment, as they have already more orders than they can fill. It, therefore, becomes necessary to look to our own foundries for the national armament. It has been determined to contract with private firms for the manufacture of the rough steel, and provide for the assembling and finishing of the parts at the Frankford Arsenal, Philadelphia, and at the Washington Navy Yard.

It is now provided that the Secretary of War and the Secretary of the Navy are to be authorized jointly to make contracts with responsible steel manufacturers, after suitable advertising, for the supply of rough bored, rough turned, and tempered steel in forms suitable for heavy ordnance for army and navy purposes. Its quantity is not to exceed 10,000 gross tons. In quality and dimensions, it must conform to specifications, and be subject to inspections and tests at each stage of manufacture. It is provided that no money shall be expended, except for steel accepted and delivered, and that each bidder shall contract to erect a suitable plant in the United States. Such establishments must be equipped with the best modern appliances, and capable of making all the steel required, and of finishing it in accordance with the contract. The bidder must also agree, in case of an ordnance contract, to deliver yearly a specified quantity of each caliber. The time of delivery as now stipulated for the smaller calibers is to commence at the expiration of not more than eighteen months from the date of the execution of the contract, and for the largest calibers at the expiration of not more than three years. It is also provided that all the forgings must be of American product, and manufactured in the United States. One-half of the material purchased is to be for the use of the War Department, and the other half for the Navy. Six million dollars have been appropriated for this purpose, to be available during six years from the date of the execution of the contract.

Four hundred thousand has been apportioned for the thorough equipment of the Frankford Arsenal, and two hundred thousand for additional tools and machinery for the Washington Navy Yard. Minor sums were also appropriated for the construction of cast iron mortars and other purposes.

The full discussion which this question received in Congress has shown that under the most favorable conditions it will take several years to provide for the adequate protection of our seaport cities. In the interval, they are left at the mercy of circumstances. It is true that we are now so fortunate as to be at peace with all the world, but it is impossible to have any guarantee that this condition of affairs will continue for any length of time. It is at such a period that defensive preparations should be made, and not when war is actually at hand. In urging an extensive and complete system of fortification, we hope that a higher civilization will prevent the necessity of ever testing its efficiency in battle. It is, however, quite well recognized in international history that an improved armament is fully as valuable in preventing war as in gaining victories when hostilities have once been declared.

DISEASE GERMS IN MILK.

It is a well recognized fact that the mother who is nursing her child is obliged to be very careful about her diet, for whatever she eats or drinks has its effect upon her milk, and consequently upon the health of her child. The most acute symptoms, and even death, may be produced by dietary indiscretion. But it is less appreciated that similarly alarming results may be produced in both children and adults by the use of milk taken from improperly fed cattle. There have recently been a number of mysterious poisoning cases, that after a great deal of random speculation have finally been traced to diseased milk. In spite, however, of these warnings, the subject has not yet received the sanitary attention to which it is entitled. Particularly is the danger of such contamination great in the neighborhood of large cities, where the absence of wholesome pasturage is a temptation to the less scrupulous to substitute all grades of organic refuse, the most of which should properly be consigned to the garbage crematory. In addition to this danger, however, it is discovered that even in the presence of abundant and suitable food, cattle are not discriminating in their selection, but exhibit frequently the most depraved tastes. In the neighborhood of large distilleries, it has been observed that the cattle become utterly demoralized by feasting on the refuse from the stills. In time they come to have the dull, stupid appearance characteristic of an opium eater. It is hardly possible that the milk produced by animals permitted to feed on such abominable stuff can be either wholesome or agreeable.

In other places the case is even worse, for the cattle have been observed to feed with evident relish upon unadulterated animal excreta and other highly pernicious food. Aside from the disgust which the practice excites, it is a source of actual and grave danger. When it is remembered that the fatal plague at Plymouth, Pa., was directly traceable to the careless disposal of the excreta of a single typhoid fever patient, it can readily be seen that milk may become in this manner a vehicle for the distribution of the most malignant disease germs.

So large are the possibilities for evil which may result

from the use of milk taken from animals improperly fed, either through design or carelessness, that it is not too much to ask that all public dairy farms should be placed under sanitary supervision, and that the food and quarters of all cattle whose milk is offered for sale should be regularly inspected by officials appointed for the purpose.

As to Our Length of Life.

BY THOS. S. SOZINKSEY, M.D., PH.D., OF PHILADELPHIA.

One meets frequently in the course of his general reading, and even in scientific publications, declarations to the effect that of late the length of human life, as well as the vital stamina of the race, has markedly increased. Some assert that the average age has been run up ten, fifteen, even twenty years, but a doctor of hygiene puts the case moderately thus: "The average duration of human life has increased, and all the evidence, I think, is in favor of the view that we are a better stock or race than we were a few years ago." "A few years" are sufficient to work material changes in the "stock or race"! Let the disciples of Darwin take notice.

The asserted increase in the length of life and vital force is attributed to more hygienic living, due in great part to the growth and diffusion of sanitary knowledge, which is said, of course, by the enthusiastic doctor of hygiene, to be a span-new science. Our forefathers were an ill-conditioned and ignorant set—they did not know anything about right living. Shades of Hippocrates and other great lights of the past, take no offense at modern presumption!

Macaulay spoke with great force, as was his wont, of the improved condition of the English people in his day. "The term of human life," said he, "has been lengthened over the whole kingdom, and especially in the towns;" but it is nearly forty years since the historian wrote, and, of course, the hygiene of forty years ago, according to the modern doctor, being of little account in comparison with what it is to-day, there must have been considerable addition since to "the term of human life;" for be it known that an increase of "the term of human life" goes *pari passu* with the modern "strides" in sanitary science. The day dawns, to be sure, in which men will live as long as the antediluvians!

Such statements are apt to be very agreeable to *amour propre*, but are they really true? Is the vital condition of the race improving?

The volume of the United States Census Reports of 1880, which has been issued recently, furnishes an interesting mass of plain, unvarnished facts bearing on the subject in question. During the census year it appears that of a hundred deaths reported, forty were of persons under five years of age, fifty-two were of persons under twenty, and only twenty-two were of persons over fifty. Only about ten per cent survive their threescore years and ten. Twenty-four per cent, or nearly a quarter, of the deaths are of persons between twenty and fifty years. Here is the table in detail:

AGE.	DEATHS IN 100.
Under 1	23·24
1 to 5	16·90
5 to 10	5·71
10 to 15	3·04
15 to 20	3·89
20 to 30	9·61
30 to 40	7·60
40 to 50	6·49
50 to 60	6·22
60 to 70	6·88
70 to 80	6·38
80 to 90	3·28
90 to 95	0·43
95 to 100	0·26
Unknown	0·42

These astounding figures represent the mortality according to age, as already intimated, for the entire United States. For the thirty-one cities in which the deaths were registered during the census the showing is far worse. "Under five years of age the proportion of deaths (reported) in the country at large was forty-three and seven-tenths per thousand of living population, while in the registration cities it was eighty-eight and four-tenths per thousand. In other words, the mortality of children under five years of age . . . was about twice as great in the cities as in the average of the whole country." So it is said in the Census Report. Of course, if a far greater proportion of the deaths in the whole country of persons under five years than of those older were not reported, which was certainly the case, the percentages given in the table of deaths of those dying at different ages of over five years are much greater than they really ought to appear; for *il va sans dire* that the greater number of deaths of very young people, the lower is the average age at death. Even as the table stands, the average age is not far up in the twenties.

In France forty-eight per cent of the deaths are of persons over fifty years of age; and what is more remarkable, twenty-five per cent are of persons over seventy years of age. The French present the best showing, except, perhaps, the Irish, of any nation as regards long life. Only about twenty-six per cent of their deaths are of children under five years. About six per cent only are of persons from five to twenty years.

For the purpose of comparison the following table of percentages of mortality at different ages in England and Wales in 1880 may be given:

AGE.	DEATHS IN 100.
Under 1	25·48
1 to 5	16·98
5 to 10	3·66
10 to 15	1·73
15 to 20	2·23
20 to 25	2·61
25 to 35	3·51
35 to 45	6·36
45 to 55	6·88
55 to 65	8·75
65 to 75	10·06
75 to 85	7·66
85 and over	2·09

According to this table, the deaths of persons from five to twenty years of age were less than eight per cent of the whole; while in the United States they were over twelve. The deaths of persons from twenty to fifty-five years of age were twenty-one per cent of the whole; while in the United States the deaths of persons from twenty to fifty were more—twenty-four per cent. The deaths of persons over seventy-five years of age were about equal to the deaths of persons over seventy in the United States.

As serving to show how much other things than the advancement of practical hygiene have to do with the length of human life, the following table of the percentages of deaths at different ages in Ireland, in 1880, is highly interesting:

AGE.	DEATHS IN 100.
Under 1	13·98
1 to 5	11·60
5 to 10	4·00
10 to 15	2·53
15 to 20	3·41
20 to 25	3·85
25 to 35	5·62
35 to 45	5·78
45 to 55	6·54
55 to 65	10·77
65 to 75	14·05
75 to 85	13·30
85 to 95	3·72
95 and over	0·80
Unknown	0·05

Let the modern doctor of hygiene look critically at these figures. No nation of Europe is supposed to be more oblivious of sanitary science than the Irish, and yet a far greater percentage of the people of Ireland than of any other people, except the French, live to and beyond the age of seventy years. Nearly five in a hundred of the deaths are of persons over eighty-five years of age! Only about thirty-five per cent of the deaths are of persons under twenty years of age. About forty-two per cent of the deaths are of persons over fifty-five years. One-half almost of the deaths are of persons over forty-five years. In England and Wales only thirty-three per cent of the deaths are of persons over forty-five years, while in the United States only thirty per cent are of persons over forty years of age.

Let the boastful doctor of hygiene say what he will, the vital condition of the people of neither England nor the United States is satisfactory; it is lamentably unsatisfactory. I know of no sound evidence pointing the other way. Appealing to the experience of life insurance companies does not meet the case at all, for the simple reason that the very young, the frail, and the diseased are very carefully excluded from regular insurance. Then, if the physical condition of the people of Ireland, a people poor and comparatively ignorant of sanitary science, is immensely superior to that of either, there must be influences at play in both England and the United States which much more than counterbalance all the beneficial effects of the sanitary science in practice in either country. Climate has something to do in the case, but the mode of living of the people far more. There is only too much reason for the belief that the very artificial mode of existence general in civilized countries is harmful. In other words, the less natural one's mode of living is, the more likely are his vital powers to become impaired.

The multiplied appliances and complex ways of highly civilized life do not make for health and long life. The comparatively uncivilized do not suffer much from disease, or at least non-contagious disease, and their offspring are not doomed to die in great part in their infancy. The simple habits of those who live close to nature are most favorable to real human welfare. To live close to nature, which in general means in accord with nature—that is the cardinal axiom which the doctor of hygiene would do well to specially inculcate. To this I may add, by way of conclusion, that Mephistopheles, who, unlike the modern doctor of hygiene, was wont to say, "*allwissend bin ich nicht*," gave Faust passing advice as to how to preserve his youthful health and vigor:

"Betake thyself to yonder field;
There hoe and dig as thy condition;
Restrain thyself, thy sense and will
Within a narrow sphere to flourish;
With unmixed food thy body nourish;
Live with the ox as ox, and think it not a theft
That thou manur'st the acre which thou reapest;
That, trust me, is the best mode left
Whereby for eighty years thy youth thou keepest."

—*Med. and Surg. Reporter.*

The Adjournment of Congress.—No Changes in the Patent Laws.

Congress adjourned August 5. Among the notable bills passed was one for the protection of public lands. The failure of Western railroads to fulfill the conditions stipulated in their grants has led to the reannexation of 190,625 square miles to the public domain. The lawless cattle syndicates, which were fencing off millions of acres to which they had no possible claim, have also been brought under the dominion of the law. The oleomargarine industry received a severe blow by the passage of a bill imposing a tax of two cents a pound on the article, and requiring both stamp and brand. The naval bill provides for the addition of two sea-going armored vessels, one protected cruiser, and one first-class torpedo boat, while the four double-turreted monitors now in course of construction are to be completed. The river and harbor bill, appropriating $14,473,900 for national works, has been approved.

None of the various bills for the curtailment of the rights of patentees was passed. The copyright bill for foreigners to register copyrights also failed to pass.

New Canals in Russia.

A new canal, improving the water communication between the Caspian and the Baltic, was opened by the Minister of Ways of Communication, Gen. Possiet, recently. The canal, which has cost 300,000*l.* to construct, joins the rivers Wyhegra and Kovja, and forms a fresh link in the chain of waterways known as the Maryinsky system, connecting the Neva with the Volga. Its length is 22 versts, or 15 miles, width 70 feet, and depth 7 feet. Some of the cuttings through which it runs had to be excavated to the depth of 30 feet. Most of the work has been done by hand, upward of 20,000 laborers having been employed in the undertaking, together with three dredging machines, nine stationary engines, and two locomotives.

Upward of 270,000 Russian cubic fathoms of earth had to be removed in making the canal, and two sluices constructed. Compared with the rest of the vast canal system between the Neva and the Volga, the new link was neither an extensive nor a formidable undertaking, but it has relieved the pressure of traffic on the other canals, and shortened the distance from Rybinsk to St. Petersburg. It is noteworthy, says *Engineering*, that in spite of the development of the Russian railway system the traffic on the canals shows no sign of diminution, a phenomenon quite the reverse of what has occurred in England. This is to be explained, perhaps, by the fact that distances are greater in Russia, while the canals are more like rivers than the narrow waterways common to England.

Barges on Russian rivers and canals range in length from 100 feet to 300 feet. The cargoes a large proportion of them carry, consequently, are as large as many an ocean cargo; and instead of being mere lighters, carrying only portions of cargoes, they are to all intents and purposes the counterparts of ocean-going ships. Thanks to the wide reaching ramifications of the River Volga, the largest in Europe, barges of 500 or 1,000 tons can start in the spring with the floods from some tiny stream in the Ural Mountains, and arrive in the autumn on the River Neva. On the other hand, it is possible for English steamers to make their way from the Neva through the canal system to the Volga, and thence descend to the Caspian Sea. The Neva-Volga canal system thus possesses an importance which no English canal could claim, although we think that water carriage in this country deserves to be rescued from its present neglected and decaying condition, into which it has lapsed through the instrumentality of ambitious and over-grasping railways.

The Planet Mars.

Mr. W. F. Denning has made a series of careful drawings of the appearance of the planet Mars this year, and finds the edges of the seas very brilliant and well defined. The surface markings of the planet are very varied, and in some places distinctly mottled; and during the past few months the north polar cap has been very bright, and in startling contrast to the less luminous regions. Mr. Denning thinks that the atmosphere of Mars, instead of being dense and cloud laden, is extremely attenuated; and that most of the supposed changes in the latter are really due to changes in the earth's atmosphere.

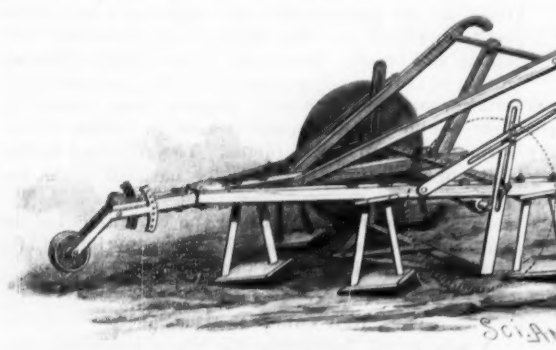
A Liniment for Earache.

According to the *Canada Medical Record*, Pavesi recommends a liniment composed of camphorated chloral 2½ parts, pure glycerine 16½ parts, and oil of sweet almonds 10 parts. This is to be well mixed, and preserved in a hermetically closed bottle. A pledget of very soft cotton is to be soaked in the liniment, and then introduced as far as possible into the affected ear, two applications being made daily. Frictions may also be made each day with the preparation behind the ear. It is claimed that the pain is almost immediately relieved, and even in many cases the inflammation is subdued.

IMPROVED CULTIVATOR.

The accompanying illustration represents a one horse cultivator which is the invention of Mr. George E. Briggs, of Bowling Green, Mo.

The front ends of the side beams are pivoted to the center beam in such a way that their rear ends have a lateral movement. To the rear parts of the side beams are bolted the other ends of two bars, whose inner portions overlap each other, and have holes through which passes the bolt that secures them to



BRIGGS' IMPROVED CULTIVATOR.

each other and to the central beam. By adjusting this bolt, the distance between the side beams may be regulated according to the distance between the rows of plants. At the acute angles of diamond-shaped cutters are secured knife standards, whose upper ends are bolted to and between two bars having outwardly projecting lugs that rest against the lower sides of the beams. The extremities of the standards pass through the beams, and have nuts screwed upon them. In the lower sides of the beams are tapered recesses, to form inclined seats for bars which give a downward inclination to the forward ends of the cutters. These cutters are so arranged that their paths will slightly overlap, in order that all the grass, weeds, and vines will be cut off. The depth to which the cutters enter the ground is regulated by a front-gauge wheel, which can be raised or lowered as required. Two rotary colters are attached to the outer ends of an extensible shaft, which can be adjusted to correspond with the adjustment of the side beams. To a wide V-shaped cutter are attached the ends of standards having longitudinal slots in the upper parts, to receive bolts that secure them to the side beams; the cutter can thus be arranged to work at a greater or less depth in the ground.

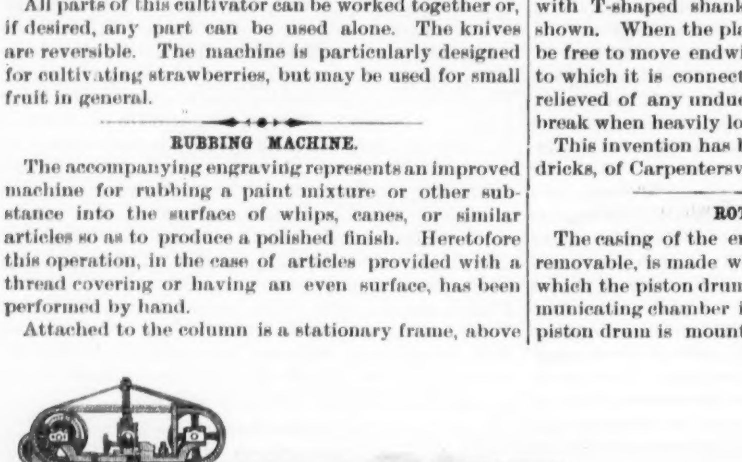
In the upper ends of the standards are bolts that pass through slots in braces, as shown; by this means the inclination of the cutters can be varied.

All parts of this cultivator can be worked together or, if desired, any part can be used alone. The knives are reversible. The machine is particularly designed for cultivating strawberries, but may be used for small fruit in general.

RUBBING MACHINE.

The accompanying engraving represents an improved machine for rubbing a paint mixture or other substance into the surface of whips, canes, or similar articles so as to produce a polished finish. Heretofore this operation, in the case of articles provided with a thread covering or having an even surface, has been performed by hand.

Attached to the column is a stationary frame, above which is a similar frame mounted to slide vertically. Cast on the column is a plate, which forms a support for a second plate carrying a pulley at each end. Over these pulleys and the upper side of the second plate passes an endless belt covered with felt or other similar soft material, and over a part of which passes an endless piece of canvas, held taut on the felt by being passed over a roller that may be adjusted up or down. The upper or movable frame is of like construction, and is pivoted to the top of a lug cast on an arm which supports its plate, and is attached to a hollow shaft mounted to slide vertically in the hollow column. The shaft of the lower left hand pulley has a cog wheel which meshes with a second wheel mounted on a stud fastened to a bent arm fulcrumed on the shaft. The second wheel meshes with a third one, also carried by the bent arm, and which meshes with a wheel carried by the upper shaft. To the upper end of the bent arm is pivoted a link fulcrumed on the shaft of the upper pulley. On the lower shaft are mounted the driving pulleys. By this means the pulleys carrying the endless belts are revolved.

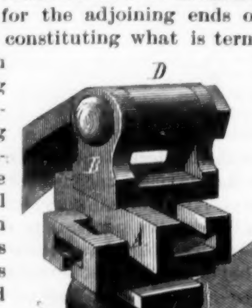


VAN DEUSEN'S RUBBING MACHINE.

The whip or other similar thread-covered article, prepared with a paint mixture which is to be rubbed into the surface, is placed between the canvas belts, when the operator, by pressing upon a suitably connected lever, causes the upper frame to slide downward. The article will be embraced between the endless moving belts, the soft material inclosing it completely, and as the whip is pulled in a direction contrary to that of the belts (to the right in the engraving), the paint mixture will be thoroughly rubbed into the surface. The canvas belt prevents the mixture from coming in direct contact with the soft material. When the pressure on the treadle is removed, a coiled spring raises the shaft carrying the upper frame. This machine is the invention of Mr. C. R. Van Deusen, of firm I. S. Van Deusen & Son, Whip Manufacturers, Passaic, N. J.

PLATFORM SPRING FOR VEHICLES.

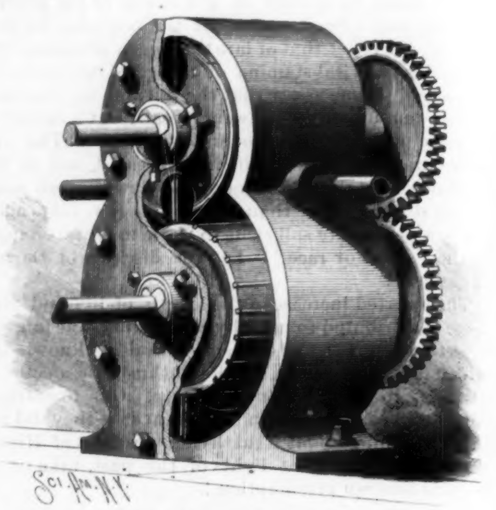
The object of the invention herewith illustrated is to provide a coupling for the adjoining ends of the several sets of springs constituting what is termed a platform spring, which will prevent all rattling and permit of an extension of any one spring without a corresponding movement of the others. The central block, A, is made with two T-shaped grooves running at right angles to each other. One end of each of the grooves is closed, and the closed end is toward the spring when the parts are assembled. The blocks, BB', to which the springs, D D, are united, are formed with T-shaped shanks that fit within the grooves as shown. When the platform is loaded, each spring will be free to move endwise without twisting the springs to which it is connected, and the springs being thus relieved of any undue twisting strain are not likely to break when heavily loaded.



This invention has been patented by Mr. E. A. Hendricks, of Carpentersville, Ill.

ROTARY ENGINE.

The casing of the engine, one side plate of which is removable, is made with a lower circular chamber in which the piston drum works, and with an upper communicating chamber in which the valve works. The piston drum is mounted upon the main shaft, and is provided with rigid radial vanes. The valve is circular in shape, and is formed with opposite cavities, into which the vanes enter as the piston and valve revolve, proper registration of the vanes with the cavities being maintained by two cog wheels, mounted upon the two shafts, which mesh with each other. To insure steam tight contact of the valve with the piston, the outer surface of the latter is furnished with packing strips set in groves in the drum; and to prevent the escape of steam at the time the vanes pass the valve, flat springs are placed upon each side of the cavity. The outer edges of the springs also run in contact with the walls of the valve chamber, and prevent steam from blowing through the chamber from the induction pipe to the exhaust pipe. The vanes have adjustable steel packing strips, which are constantly pressed outward by springs, thereby constituting a yielding steam packing for the vanes. The steam supply and exhaust pipes are placed on opposite sides of the casing, and a little above the point of contact of the valve with the piston. By means of suitably arranged packing, all escape of steam at the journals is obviated. In order that any wear on the outer surface of the packing rings of the piston may be compensated for, both shafts can be adjusted. The wear on the journals can be taken up, and the proper parallelism of the valve with the piston can always be maintained, which is essential to the satisfactory operation of the engine, and to avoid unnecessary friction. It will be perceived that the engine has no dead center, and that it may be reversed by simply changing the course of the steam.



BELT'S ROTARY ENGINE.

This invention has been patented by Mr. P. P. Belt, of Columbus, Kas.

SWITCH STAND.

In the lower part of the stand, the shape of which is plainly shown in the engraving, is a squared aperture, through which is passed a squared neck projecting from the under side of a toothed clutch disk. Interlocking with this disk is a second one mounted on the squared part of a shaft passing through the stand. Surrounding the shaft is a spring, arranged so as to press the upper disk against the lower one. A continuation of the shaft carries the signal.

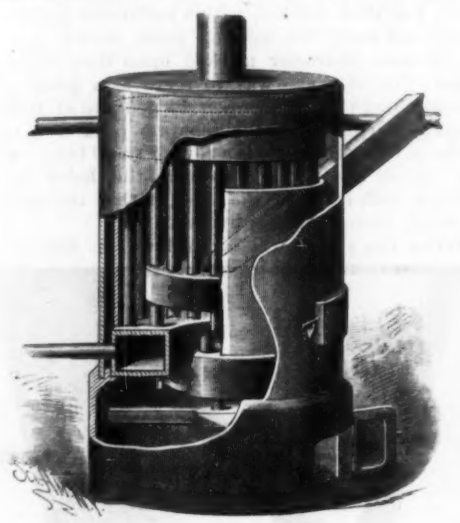
Pivoted to the shaft is a lever, which, when the switch is locked, occupies the position shown in the engraving, and is held in place by the shackle of a padlock passed through the eye. The lever then bears against a collar that passes through the opening in the top of the stand and rests on the spring, which, being under tension, presses the upper disk against the lower one. When the switch is to be thrown, the lever is swung to a position at right angles to the shaft, when, the pressure on the spring being relieved, the shaft may be turned by the lever, the teeth of the upper disk sliding over those of the lower. When the lever is swung down and locked, the shaft cannot be turned, as sufficient leverage cannot be obtained, the tension of the spring being so great as to make it impossible to cause the teeth of the upper disk to slide on those of the lower one.

SINGISER'S SWITCH STAND.

This invention has been patented by Mr. Henry C. Singiser, of Mechanicsburg, Pa.

IMPROVED STEAM HEATER.

Resting upon the base is a sheet iron casing, to the center of the top of which the smoke pipe is connected. Upon the inner part of the top of the base rests an annular water chamber, beneath the central aperture of which the grate is supported. With the outer part of the top of this chamber are connected tubes that lead to a circular water chamber, so placed a little below the top of the casing that the products of combustion will have a free passage around the



BRONSON'S IMPROVED STEAM HEATER.

sides and at the top of the chamber. A third chamber is connected by pipes with both the upper and lower ones. A chute connected with a central aperture in the middle chamber passes through an opening in the upper part of the casing, and serves as a magazine for coal, making the heater a self-feeder. The circles of pipes are interrupted for the passage of the chute and to give access to the fire chamber. A feed pipe is connected with the lower chamber, and from the upper one leads one or more pipes, through which steam is conducted to the rooms to be heated. Within the casing, close to the outer circle of tubes, is a second one, whose lower edge rests upon the lower water chamber. The upper edge does not extend quite to the upper chamber, a space being left for the passage of the products of combustion, which pass through the aperture in the middle chamber, between the tubes, and thence around the upper chamber, heating the water and generating steam very rapidly. The inner casing keepsthe products of combustion close to the pipes, and prevents waste of heat by radiation.

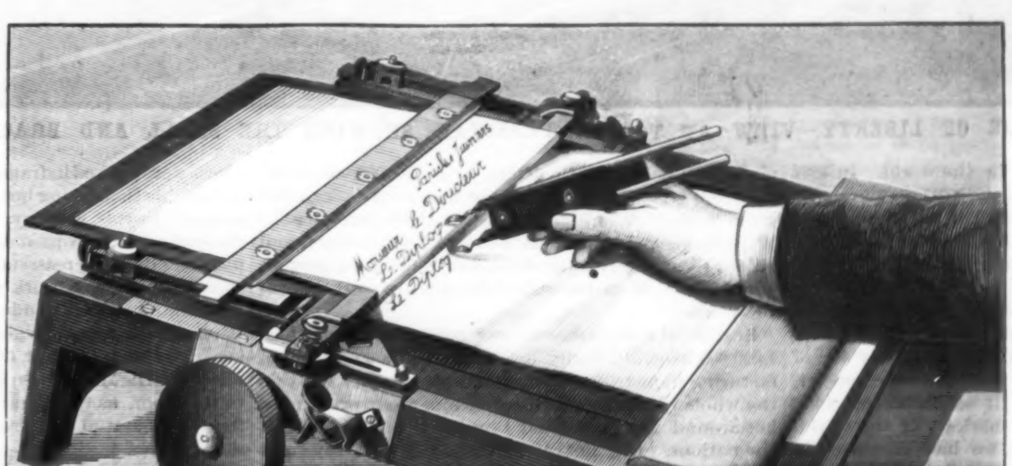
This invention has been patented by Mr. William C. Bronson, of Saratoga Springs, N. Y.

LEVESQUE'S DIPLOGRAPH.

Every one knows how easy it is to write double with two pens fixed to the end of the same handle; but, in order to make a useful application of the process, it is necessary to find some means of writing upon two different sheets of paper at the same time. The problem has been solved by Mr. Levesque, through a desk which he has just constructed, and which he calls a "diplograph."

The apparatus consists of a board which, through two lateral rabbets, slides in a frame inclined toward the writer. A tablet, placed transversely at a few fractions of an inch above the board, is fixed by its two ends upon two small brackets fastened to the sides of the frame.

The lower sheet of paper is laid flat upon the board, and is held by the pressure of a strip of steel. The upper sheet is grasped at its upper edge by a long clip, whose extremities are fixed at will to the head of two small supports which are themselves fixed at the height of the board.



LEVESQUE'S DIPLOGRAPH.

When a page of writing is begun (the board having been brought to the lower part of its travel), that part of the upper sheet that is to receive the first line rests upon the tablet. The lower portion of this sheet is folded back, and is pressed against the bottom of the tablet by a strip of wood covered with velvet. One of the two pens writes upon that part of the upper sheet that rests upon the tablet, while the other traces the same characters upon the corresponding part of the lower sheet.

After each line has been written, the tablet is shoved forward. This carries along the two sheets, the upper one of which, being thus drawn upward, and held below by the paper press, remains tightly stretched upon the tablet, while at the same time moving the same distance upward that the lower sheet does. It is thus possible to write the following line upon both sheets at once.

A sheet of stiff cardboard is interposed between the two sheets of paper, so as to prevent the upper one from confusing the writing traced upon the lower.

The board is moved by means of a cord running over a pulley which is placed beneath the frame, and the axle of which is provided at one extremity with a wheel that the writer revolves with his left hand, without having to pay any attention to it. The forward motion is, in fact, regulated line by line by a gearing that may be set at will in such a way as to have differently spaced lines.

As the instrument contains no delicate parts, it is very strong. Those that a violent shock might break can, moreover, be easily replaced by any one who has ever seen the apparatus.

This desk is certainly ingenious, and can be used in public o private offices, and everywhere where a person needs to obtain, at once and without preparation, two copies exactly identical, word for word, line for line.—*La Nature.*

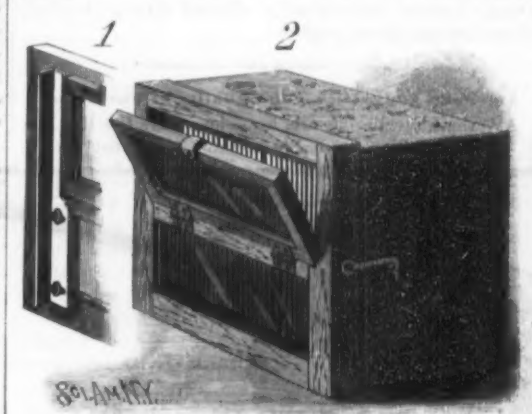
The Manchester Ship Canal.

The Manchester Ship Canal will extend from the deep water of the Mersey at Eastham—a point on the Cheshire shore just above and almost opposite to Liverpool—and will proceed thence by Ellesmere Port, Runcorn, Warrington, and Barton to Manchester, being in length about thirty-five miles. It will have a minimum depth of 26 feet of water, and will be wide enough for the largest vessels to pass each other at any point, and may be compared with the Suez and Amsterdam canals, in width and depth as follows: Suez, depth 26 feet, bottom width 72 feet. Amsterdam, depth 23 feet, bottom width 89 feet. Manchester, depth 26 feet, bottom width 120 feet. The estimates include docks in Manchester, Salford, and Warrington, as sanctioned by the company's act, with a water area of 85½ acres, containing more than four miles of quays. There will also be a mile of quay space and extensive shed accommodation near Manchester on the ship canal, in addition to wharfs at many places alongside its course. The level of the docks at Manchester, which is 60 feet 6 inches above the ordinary level of the tidal portion of the canal, will be reached by four sets of locks. The locks will, it is asserted, be of a size sufficient to admit the largest merchant steamers.

Each set comprises a large lock, 550 feet by 60 feet; a smaller lock, 300 feet by 40 feet, for ordinary vessels; and one lock 100 feet by 20 feet, for small coasters and barges—and all capable of being worked together. Each set of locks will be worked by hydraulic power, enabling, it is contended, vessels to be passed in fifteen minutes. It is hoped that the rivers Irwell and Mersey—which will be diverted into the upper reaches of the canal—will supply more than sufficient water for the locks even in the driest season. Vessels will, it is expected, be able to navigate the canal with safety at a speed of five miles an hour, and it is estimated that the journey from the entrance at Eastham to Manchester will be accomplished in eight hours.

CRACKER BOX COVER.

This cover may be readily applied to or removed from the box, and may be adjusted to fit boxes of different sizes. The frame of the cover is provided with a glass panel and a hinged glass door. In the inner edge of the upper crossbar is a staple, and to the inner surface of the door is secured a flat spring, bent around the edge and made convex, so that, when the door is closed, the spring will be brought into engagement with the staple. This spring serves the double purpose of a buffer, preventing the door from being closed too hard, and of a fastener. Along one edge of the under side of the frame, as shown at the top of Fig. 1, is secured an angle plate, and to the ends of the frame



SANDBERG'S CRACKER BOX COVER.

are secured angle plates formed with slots for receiving clamping screws. These plates may be moved in or out, to adapt the distance between them to the length of the box. On the ends of the frame are hooks for engaging nails or eyes in the ends of the box, for holding the cover in place. This cover permits of displaying the contents of the box, while effectually excluding dust and moisture.

This invention has been patented by Mr. C. G. Sandberg, whose address is P. O. Box 103, Helena, Arkansas.

The Dangers of Dust.

Darkness, damp, and dust are potent agencies of disease. Everybody recognizes this; but how many fail to adopt its precepts! If there be sermons in stones, surely the summer dust and its dangers would prove a fruitful subject for medical discourse. There is as great a difference between London and country dust as there is between the corresponding muds. Pulverized matter would be harmless enough if it were deprived of its physical property of ready diffusion. The atmosphere is laden and swarms with particulate matter of highly complex nature. Its chief peril to living beings resides in the organic constituents; largely this organic material consists of minute forms of life in a state of latency, only waiting for a spell of heat and moisture and a favorable amount of light, or it may be darkness, to awaken it into activity. The habits of individuals in every class of society, including the "masses," are not calculated to diminish, but rather to augment, the amount of organic matter in our atmosphere. Mucus, saliva, and humor, popularly known as "matter," must be discharged from the mouth and nostrils to the extent of many gallons daily, and not a little of this comes from infective sources; while we venture to think that the bulk of it mingles with the dust of our streets and courts. If, as seems not unlikely, consumption is largely caused by "germs," then a very ready theory may be advocated concerning the mode in which contagium is caught. Who can estimate the amount of mischief that the shaking of mats may have caused? How many young girls early in the morning on their way to business have, so to speak, received their death blow while inspiring, all unconscious of harm, some of the clouds of dust that always greet them? Who can tell? The abatement of this danger and nuisance is a difficulty that almost seems insurmountable. Much may be done by personal habits of prevention.—*Lancet.*

THE greatest length of Lake Huron is 250 miles; its greatest breadth, 190 miles; mean depth, 800 feet; elevation, 578 feet; area, 21,000 square miles.

Animal Power vs. Steam.

Mr. A. Sanson, in an article in a recent number of the *Revue Scientifique*, states that, from a comparison of animal and steam power, in France at least, the former is the cheaper motor. In the conversion of chemical to mechanical energy, 90 per cent is lost in the machine, against 68 in the animal. He finds that the steam horse power, contrary to what is generally believed, is often materially exceeded by the horse. The cost of traction on the Montparnasse-Bastille line of railway he found to be for each car, daily, 57 francs, while the same work done by the horse cost only 47 francs; and he believes that, for moderate powers, the conversion of chemical into mechanical energy is more economically effected through animals than through steam engines.

American Industries.—The Quality of Our Labor.

American mechanics are, as a class, says the Rev. W. V. Davis, in Cleveland *Plaindealer*, the most intelligent, ingenious, and instructive in the world. In 1884 our American Patent Office issued 20,297 patents. At the recent International Electric Exposition in Paris, five gold medals were given for the greatest inventions or discoveries, and all five crossed the ocean to the United States.

Even so strong a Britisher and calm a writer as Mr. Herbert Spencer says we have the best mechanical appliances and mechanics in the world. Now, any one of these advantages would insure ultimate supremacy if it be rightly used. What, then, if all three coincide? Plainly, it ought to give us the markets of the world. Already, six years ago, in 1880, we had surpassed in manufacture by $650,000,000 Great Britain, hitherto the imperial mistress among nations. So soon did Mr. Gladstone's keen forecast come true that we should ultimately become the head servant in the world's great household. From 1870 to 1880 the manufactures of France increased $230,000,000, of Germany $430,000,000, of Great Britain $580,000,000, and those of the United States increased $1,030,000,000. And think of it! We are just beginning to develop our resources, while many of these nations find many of theirs well nigh exhausted. Even now, the superior intelligence of our mechanics can compete against the cheaper labor of Europe. Even now, in spite of their cheap labor, we can lay down our steels in Sheffield, our certain lower grades of cotton in Manchester, our electroplate in Birmingham, our watches in Geneva, and undersell European manufacturers at their own doors. If this is the beginning, what, then, of the possible future? And then add to this how just now our markets are being rapidly extended under the impulse of electricity and steam as never before.

We are next neighbor to all the nations; to South America, just quivering with its new life; to Japan and China, just waking up from the sleep of ages; to Africa, with its wonderful and mysterious future greatness. Within these twenty years it was as if the dead bones of the nations had been flying into place and a living soul had entered them. It is the dawning of Christian civilization for a billion of people who do not yet enjoy it. And Christian civilization means higher, nobler material as well as intellectual and spiritual wants. After the missionary always goes commerce. Five hundred American steel plows went to the native negro Christians of Natal, South Africa, last year. All the millions of Asia and Africa are going to have their civilized cravings, as we do, some day. India, just beginning to be a little Christian, took $12,000,000 worth of cotton goods last year. What may all Asia want 100 years hence? What may Africa want 100 years hence? With those vast continents added to our market, and all our natural advantages realized, what is to prevent our country from becoming the mighty workshop of the world?

Realize the resources of our agriculture, and feed 1,000,000,000 souls! Fully develop our mining and manufacturing industries, which would be enough to sustain the whole billion; gain the pre-eminence in every market around the globe, and become the handmaid of the nations. Did not Mr. Matthew Arnold say right in his lecture to us a year and a half ago, that "America holds the future"?

Diminutive Mail Matter.

The postal service at Liverpool, England, recently had an experience which, if often repeated, would prove the reverse of amusing. Some one whose ingenuity or economy was searching for new fields wrote a message of twenty-six words on the back of a two cent stamp, which was duly posted and delivered. This success led to a second experiment and then to a third. But on the last occasion, a one cent stamp was chosen, and was accordingly held as an insufficiently prepaid letter.

THE STATUE OF LIBERTY NEARING COMPLETION.

Even those unacquainted with the details of such work may, by carefully considering all the conditions involved, form a tolerably accurate idea of the labor expended and the patience and skill exercised in the erection of such a structure as the Statue of Liberty. The last operation before the figure left France was the assembling of all of the many pieces comprising the shell or statue proper and the final fitting of each piece to each of its surrounding neighbors. Each piece was then marked with a particular number or figure, and every two meeting pieces were designated by the same character marked upon their adjoining edges; this of course was to serve as a guide when reassembling the statue upon its pedestal at Bedloe's Island. Surrounding each separate piece at a short distance from the edge is a row of small holes; when two pieces are joined together, the holes in one coincide with those in the other, so that the two may be firmly united together by rivets.

STATUE OF LIBERTY.—VIEW AT TOP OF PEDESTAL, SHOWING THE SHELL AND BRACING.

When the statue was taken down, in France, the pieces were packed in frames of wood, to prevent as much as possible their being bent by handling and during the passage to this country. But it was impossible to prevent a certain amount of distortion from taking place, so that the reassembling now in progress is to some extent also a work of refitting. This, together with the drawbacks under which the men labor, particularly the great height above ground, renders the otherwise simple work of erection one of great magnitude. The thousands of rivets add most materially to the labor, as they must be so driven as not to disfigure the statue by presenting conspicuous and unseemly lines.

The copper of the shell, being only about three thirty-seconds of an inch thick, lacks rigidity, so that it was necessary to increase the stiffness of every piece, particularly those of a large size, by means of iron bars secured to the interior surface. These bars are three-quarters thick by two inches wide, are bent to closely conform to the curves in the copper, to which they are fastened by copper bands whose ends are riveted to the shell, and are so disposed and united to each other as to form a most intricate network of bracing, covering and strengthening the entire statue. The interior view of the face, upon our first page, clearly illustrates the extent of this bracing and the manner of securing it to the shell.

This bracing is connected by bars with the main

frame that holds the statue upon its pedestal, as shown by the engraving upon opposite page. By this means, the rigidity of the whole work is assured, and any wind pressure—the force most to be provided for—upon the pliable, paper-like shell is transmitted to the four massive iron corner posts of the frame, which are firmly anchored to the masonry.

All the framework in the interior of the statue was made in France; and while there is regularity in the main frame, there is nothing apparent in the connecting bracing but a seemingly confused collection of bars of all shapes and lengths, and extending in every conceivable direction. This is caused by the constant change in the direction assumed by the copper, and the endeavor not to have too large a surface unsupported.

No part of the ironwork is in direct contact with the copper, a thorough insulation being obtained by shellacking the adjoining surfaces and interposing a strip of asbestos. This is necessary to obviate the deleterious chemical action that would occur if the iron were in direct contact with the copper.

The method pursued in the erection of the statue may be briefly described. The framing has been finished with the exception of two small parts—that supporting the right hand and that of the head. The shell of the statue has been carried up only a little further than shown in the engravings.

The various pieces were temporarily stored in a shed between the base of the pedestal and the dock at which visitors are landed by the little tug plying between the Battery and the island. The piece wanted is carried to the foot of the pedestal, the face of which is protected from injury by a covering of wood, and is, if large, lashed to a wooden frame to which is attached the end of a rope passing over a derrick on top of the frame, and thence to a hoisting engine on the ground. The piece is then raised to a platform built around the top of the pedestal, and is carried to the place where its marks indicate that it belongs. When necessary, a rope and tackle are brought into play to raise the piece into position, and to hold it until enough rivets or small temporary bolts have been inserted to secure it. All the rivets are then driven, and the braces are bolted to the frame and stiffening bars. The shell is thus carried up, piece by piece, in horizontal courses. The difficulty of the work increases as the top is approached, mainly because of the increased height above ground, the top of the pedestal, where the statue begins, being 150 feet, and the torch 305 feet above water level.

There are three kinds of joints in the copper. Where it is particularly desirable that the joint should be concealed, the meeting edges are brought flush together, and are held by a double line of rivets through a strip covering the inside of the joint. In other cases one edge overlaps the other, a single line of rivets uniting them, and the outer edge is either hammered down to make a flush joint or is not touched further, the selection of the style of seam being governed by its location. The outer heads of the rivets, which are of copper, are countersunk.

The two systems of heavy girders, whose ends are embedded in the masonry in the interior of the pedestal, one at the top and the other sixty feet below, together with the four sets of eyebars that unite the two systems, have been placed in position, as shown in one of the accompanying views. These girders extend across the well at right angles to each other, and, being connected at the top with the main frame, serve to anchor the statue to the pedestal.

Lightning has several times struck the ironwork, but, owing to the means that were early taken to lead the current away, not the slightest damage has been done. Extending down each inside wall of the pedestal is a copper rod five-eighths of an inch in diameter. The lower ends of these four rods are joined to plates that were buried in wet earth beneath the bottom of the foundation before building was commenced. The upper ends are united to the frame, but will, upon the completion of the statue, be joined to four diametrically opposite points of the shell.

Up to the present time, no portion of the foundation has settled; and the solid concrete foundation proper, which is easily the largest single block of artificial stone in the world, being ninety feet square at the base, sixty-five feet square at the top, and fifty-two feet ten inches in height, with a central well-hole ten feet square, is without crack or flaw of any description. The inside of the pedestal walls are also of concrete, the face being granite, and they display the same perfection in both material and workmanship.

It is extremely doubtful if the statue can be finished by the 3d of next month, the date set for what we may term the unveiling. There is much to be done, and the rate of progress is slow, as it is impossible to employ a great number of men.

In the SCIENTIFIC AMERICAN of June 13, 1885, we illustrated and described very thoroughly the foundation, pedestal, and frame.

THE GREAT LOG JAM IN THE ST. CROIX RIVER.

BY H. C. HOVEY.

In order to comprehend the full significance of the great log jam which it is the main object of this article to describe, we must first consider the nature of the surrounding region and the stream that flows through it. The St. Croix was, in geological times, a mighty river, through whose channel the overflow of Lake Superior, and indeed the whole drainage of the interior of North America, was carried down to the Mississippi, and thence to the ocean. At present, however, it is a comparatively small but highly picturesque stream, navigable from its mouth, which is fifty miles below Fort Snelling, up to Taylor's Falls. Just below these falls are what are known as the Dalles of the St. Croix, where the channel, instead of being cut, as elsewhere, through a light-colored and soft sandstone, is suddenly confined between precipitous walls of basaltic rock, one or two hundred feet high, while the river itself has a depth of from forty to seventy feet, and yet flows with much velocity. These mural precipices are carved into caves, fissures, and curious potholes, testifying to the aqueous energy of the ancient stream by which they were made. The largest pothole observed by me was estimated to be as much as thirty feet in diameter, while many others are from five to ten feet across and from ten to twenty feet deep. There seem at first to be two distinct dikes of trap, the one at Taylor's Falls and the other at the falls of St. Croix, about a mile above the former. But more careful examination leads to the conclusion that they are portions of one dike, the intervening valley being filled in with drift. The tall cliffs are everywhere exceedingly broken and wild, with many detached fragments, and standing basaltic columns, highly angular, and even prismatic in shape. The rock is remarkably amygdaloidal, and contains copper, though hardly in paying quantities. It is undoubtedly a continuation of the famous Keweenawan formation, so extensively developed about Lake Superior.

THE GREAT LOG JAM, ST. CROIX RIVER.

The first steamboat that ever ascended the St. Croix reached the falls in July, 1838, and brought the news that the treaty made the preceding year between Governor Dodge and the Ojibways had been duly ratified, by which were ceded to the United States the extensive pine forests of the St. Croix and its tributaries. A claim was made at once around the falls by Messrs. Baker, Steele, and Taylor. The steamboat mentioned brought men and machinery for erecting here the first sawmill ever built in Minnesota. And then the crash of the woodman's ax and the splash of the mill wheel were first heard in this region, that has since become so famous for its lumber and its mills of various kinds.

From that time to this the forests along the St. Croix have been frequented by lumbermen, whose custom it has been to fell the trees in winter, cut the logs into suitable lengths for the mill, and then depend on the spring floods to carry them down to the mills below. From the falls upstream extend such interminable rapids as almost to justify the voyageur Du Luth's statement to La Salle, that, in descending it, he had "passed forty leagues of rapids." This description also applies to some extent to its tributaries, which are, in order of ascent, the Snake, the Kettle, the Clam, the Yellow, and the Nemakagou rivers.

In each of these tributaries lay last spring what is termed a heavy drive of logs; the entire aggregate being known to be about 300,000,000 feet. When the time came for sending them down the St. Croix, there first came out from the Kettle River about 75,000,000 feet of logs, which passed the rapids and the falls safely. But nearly all the remaining drives came out at once, leaving only about 14,000,000 behind. Imagine 200,000,000 feet of logs swimming together down that crooked, tumultuous river, jostling each other, playing at leap frog, diving beneath the flood, and vaulting into the air. The van at length leaped the upper and lower falls safely, but when they entered the deep and narrow canon known as the Dalles, they were piled in a heap, and at the bend of the river, about a furlong below Taylor's Falls, they were jammed into a hopeless mass, wedged firmly amid the crags. Down came the myriads of logs hurrying from upstream. The cliffs were lined with eager spectators of a scene that meant ruin to many of them; but what mortal power could stay that impetuous march? The jam was piled as high as the suspension bridge spanning the falls. Above the bridge the mass extended, very much resembling the glacier of the Rhone in shape—a glacier of logs instead of ice—for the distance of nearly three miles. I traversed it from end to end, measuring at various points, reaching the conclusion that the average thickness was about thirty feet, and the average breadth about three or four hundred feet. In several places, owing to the force of some whirlpool or the obstruction of jutting rocks or little islands, the logs are heaped up to the height of forty feet. In other places eye witnesses told me that they saw the strong current suck hundreds of logs under the upper mass, burying them in the waters below. Strange sights are to be seen. Here is a log caught by one end, and the other reared high in mid-air, like a huge flagstaff. There the case is reversed, and you just see the end of some log, whose length is vertically plunged into the mass below. Of course, the logs are of every size, from that of a telegraph pole to monstrous specimens sixty feet long and four feet through. And these are tossed about at every possible angle. Here and there may be seen some unfortunate log that was snapped in twain by being caught at a disadvantage.

As soon as the jam was judged to be done forming, so as to make it safe to experiment with it, steamboats were brought up to attack its lower end, in a faint hope of breaking it so as to cause a general drive. This was partly accomplished so as to clear the mass away that hung below the bridge, and for some distance above it. But when the foot of the falls of St. Croix was reached, the work had to be done by other methods. Dynamite was tried; but the materials were so elastic as to prevent that powerful agent from accomplishing very marked results.

The sight is highly picturesque, as one now looks up the river, seeing as far as the eye can reach that huge mass of logs, lying so wildly in grotesque confusion between the black cliffs of basalt, while troops of lumbermen, all dressed in red flannel, swarm along the front of the jam. These men select the logs that will in their judgment be most likely to set loose a number of others. A cut is made by an ax, and a heavy iron hook driven in. Word is then sent ashore by a loud shout, and the drivers whip up their horses, four of which work at a time; the cable is drawn taut, and the log thus attacked is drawn out, unless too tightly wedged in. Sometimes it shoots out alone into the stream, and again it carries with it a dozen others, and perhaps same luckless lumberman tumbles in, and is rescued amid the merriment of his comrades. Now and then a submerged log suddenly leaps to the surface and into the air like a huge porpoise. Thus the work goes on of picking the jam to pieces.

There yet remains in it fully 150,000,000 feet of logs. It is impossible to form a safe conjecture as to the length of time that may be required to release this vast accumulation of material. Meanwhile a great fortune is locked up, and the plans of thousands of people may have to be modified for a year to come by reason of this unexpected and strange calamity. The general opinion seems to be that the great bulk of the

jam will not stir before it is lifted by the freshets of next spring. There are, however, several dams up stream, which it is intended soon to open, in hopes that the artificial flood thus produced may have some effect. Thousands of visitors are attracted to the locality, the universal expression being that it is the most wonderful spectacle of the kind ever seen.

Since the above was written, a narrow passageway has been made through the center of the jam, and it is expected the work of opening the river will be accomplished in the course of a year.

Cold Hammering of Iron.

It either is or ought to be known to all practical men concerned in the working of wrought iron that if a piece of the very best and toughest iron is hammered in the process of forging until it ceases to be red hot, the effect of such cold hammering, as I may term it, is to cause the iron to become so brittle that it will in many cases break across in the process; or if it does not at that time, this process of cold hammering has so removed and destroyed its tenacity as to render it capable of being broken with the slightest blow. What renders the knowledge of the effects of such a process the more important is that in most cases we shall find that, in order to give the pieces of forged work the requisite finish and fine surface as they come from the hands of our workmen in that department, this very cold hammering and swaging, as it is termed, is required, the more so as it is by such a process that iron forgings are so finished from the hammer as to require the least possible labor after; and as every good workman in that department is anxious to turn his work out of hand with the very best surface on it, which this cold hammering enables him to do, it is not a very easy matter, and not at all desirable, to require them to discontinue the practice, which many have endeavored to do from want of a full knowledge of the subject.

There is nothing inherently wrong in this practice of cold hammering—far otherwise; the evil rests with the applying such a cold hammered piece of forge work to its purpose without having been passed through the curative process, which is simply this, namely, to heat the piece of forged work in question to a dull red heat, and lay it down to cool at its leisure. By subjecting wrought iron to the most violent hammering or compression at a low temperature, and then submitting the iron work so treated to the simple process of heating red hot and slow cooling, we enhance its tenacity or shock-sustaining qualities at least twenty times.—*J. Nasmyth, in the Architect.*

The Microscope.

It is often a matter of question with the beginner what objects shall be examined with the microscope.

The answer, roughly speaking, would be *everything;* for whatever is not already small enough, can by proper treatment be reduced to the proper dimensions. For this purpose Nature has a great storehouse of hidden treasures, which she is ever ready to render up to the diligent seeker. Field and woodland, hill and valley, earth and water, are ever at hand, teeming with wonders, many of which, too minute for the eye of man, only reveal their beauties to the microscope—the king of the invisible.

If you understand taxidermy, you will find that the birds and mammals which you handle will afford abundant material for your microscope.

2

MAGNETIC CURVES IN RELIEF.

Observe specimens of the feathers, hair, bones, and internal organs; the fresh fluids of the body (blood), the many parasites which may be found *on* and *in* all living creatures.

Sediments from various liquids may be examined, by placing a drop on a clean slide and covering.

Conical wine glasses are those best adapted for collecting sediments.

In this way the settlings of stagnant rain water, pools, etc., may be studied.

Very interesting material may often be collected in a little muslin bag tied to a faucet, through which the water is allowed to run slowly for an hour or two.

The common articles of food furnish exceedingly interesting specimens. Adulterations may thus be exposed after a little practice. The microscopic examination of drinking fluids often determines whether they are fit for use or not, by revealing the animal or vegetable matter which they may contain.

The insect world offers a delicate and beautiful anatomy for study. Observe the 7,000 divisions in the compound eye of the house fly; the delicate scales from the wings of moths and butterflies; the trachea, or breathing tubes; the suckers on a fly's foot; and hundreds of other parts.

Wonderful things are open to us in the world of

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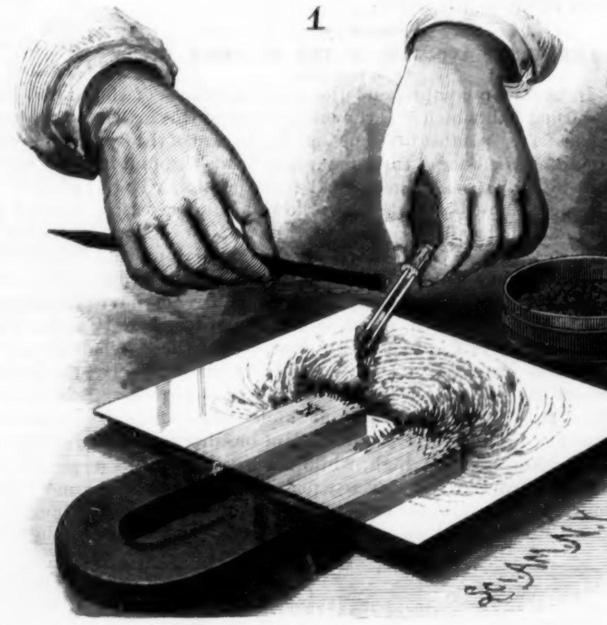

THE FORMATION OF MAGNETIC CURVES.

plants. The structure, growth, and development of vegetable life are alone enough to keep one busy for years.

Thin scales of minerals may also be examined, thus adding much to the interest of that branch of science.

But these things are not always at hand or to be had, therefore specimens whenever obtained should be preserved for future use. Prepare during the summer for the winter's work. "Take time by the forelock," and whenever you see anything which you think may be of interest, label and preserve it.

Animals and birds, if small, may be placed whole in a seventy per cent solution of alcohol, first making an opening into the abdominal cavity, to allow the fluid ready access to the internal parts. Hair, feathers, and the like may be placed in envelopes properly labeled. Parasites, small insects, etc., may be placed in spirits in homœopathic pill bottles. Intestinal parasites from birds and small mammals may be obtained by slitting the intestine open in a dish of water.

The above are a few examples of materials easily within the reach of one possessing a microscope. With patience and perseverance the beginner will soon acquire a knowledge of the microscope and microscopic technique that will always prove a source of pleasure and profit.

In this busy life we cannot spend too much time observing Nature and learning her ways. "People grow better," says Daudet, "for listening to Nature, and those who love her do not lose their interest in men."

Whatever brings us closer to Nature's heart, brings us nearer to that Supreme Being who has created all things.—*W. P. Manton.*

The Size of the Spider's Thread.

I have often compared the size of the thread spun by full grown spiders with a hair of my beard. For this purpose I placed the thickest part of the hair before the microscope, and from the most accurate judgment I could form, more than a hundred of such threads placed side by side could not equal the diameter of one such hair. If, then, we suppose such a hair to be of a round form, it follows that ten thousand of the threads spun by the full grown spider, when taken together, will not be equal in substance to the size of a single hair.

To this if we add that four hundred young spiders, at the time when they begin to spin their webs, are not larger than a full grown one, and that each of these minute spiders possesses the same organs as the larger ones, it follows that the exceedingly small threads spun by these little creatures must be still four hundred times slenderer, and consequently that four millions of these minute spiders' threads cannot equal in substance the size of a single hair. And if we further consider of how many filaments or parts each of these threads consists, to compose the size we have been computing, we are compelled to cry out, O what incredible minuteness is here, and how little do we know of the works of Nature!—*Leuwenhoek, in* 1685.

THE FORMATION AND FIXATION OF MAGNETIC CURVES.

BY GEO. M. HOPKINS.

A great deal may be learned about the properties of magnets by causing them to delineate their own characteristics. The common method of doing this is to form magnetic curves by dusting iron filings on a glass plate, then jarring the plate to cause the particles to arrange themselves parallel with the lines of force extending from the magnetic poles. The figures thus formed are not, of course, entirely autographic; and as they tend to develop in lines, they convey the erroneous idea that the lines of force, as spoken of in connection with magnets, are really separate lines or streams of force.

There is no way of exactly representing the magnetic field of force by forms or figures; but the annexed engravings serve to illustrate a method of forming and fixing curves which has some advantages over the method referred to above. The magnetic particles fall in the position in which they are to remain, and no jarring is required.

To make a flat plate for lantern projection or individual use, a plate of glass flowed with spirit varnish is laid upon the magnet, and iron dust reduced from the sulphate, or fine filings, or dust from a lathe or planer, is applied by means of a small magnet in the manner indicated in Fig. 1. The small magnet in this case consists of two magnetized carpet needles inserted in a cork, with unlike projecting poles arranged about one-quarter inch apart. A little of the iron dust is taken up on the small magnet, and the slightly adhering particles are shaken off. The remaining portion is then disengaged from the small magnet by rapping the magnet with a pencil, the small magnet being held above the poles of the larger one. The particles having been polarized by the small magnet, arrange themselves in the proper position while falling. Several applications of the iron dust will be required to complete the figure. Of course the iron must be applied before the varnish dries, and the plate should be allowed to remain on the magnet until dry.

To make the curves in relief, as shown in Fig. 2, a slightly different method is employed. The glass plate is warmed, coated with paraffine, and allowed to cool. It is then placed on the magnet, and proceeded with as in the other case. With care the curves can be built up high, especially if the larger magnet be a strong one. Iron filings or turnings of medium fineness are required in this case.

When the curves have assumed the desired proportions, a few very fine shreds of paraffine, scraped from a paraffine block or candle, are deposited very gently on the curves, and melted by holding above them a hot shovel. More shreds are then added and the hot shovel is again applied, and so on until the mass of iron filings is saturated with paraffine, when it is allowed to cool. The plate to which the filings are now attached may be removed from the magnet after having applied the armature, if it be a permanent magnet, or after interrupting the current, if it be an electro-magnet, when the curves will retain their position.

The arborescent figures shown in Fig. 3 are built upon a cap, or perhaps, more properly, on a double-crowned

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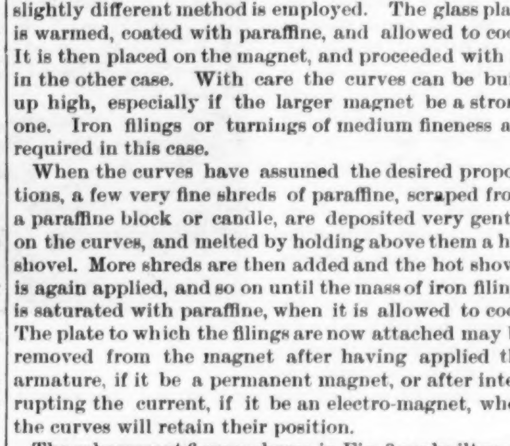


ARBORESCENT MAGNETIC FIGURES.

hat of brass, which incloses the poles of the magnet separately. The magnet in this case is arranged with its poles downward. The fixing of these curves is somewhat difficult, on account of being obliged to work under the rim of the hat, but it can be accomplished by proceeding in the manner described. Instead of the hot shovel, an alcohol lamp or Bunsen burner may be used in this case, but considerable care is required to prevent the iron dust from burning. The figure after cooling may be removed from the magnet, and preserved.

DOMESTICATION softens the whole organic structure. In the feathered species the feathering is not as dense nor as hard as on the wild fowl.

THE OCCURRENCE AND FABRICATION OF ROCK CRYSTAL.

In a paper read before the New York Academy of Sciences, on May 31, Mr. George F. Kunz presented a number of very interesting facts concerning the occurrence of rock crystal in nature, and the industries based upon it, in Japan and elsewhere.

Many ancient writers, and even such acute philosophers as Pliny, Seneca, and some of the more illustrious among the early fathers of the Church, were firm in their belief that rock crystal was nothing but water which had been congealed by a cold so intense that the ordinary methods at our command failed to melt it. Pieces of quartz were not infrequently employed as burning glasses, and were particularly recommended by Orpheus for kindling the sacrificial fires. Pliny similarly favored their use for cauterizing parts of the human body. In olden sepulchers it is not unusual to find carefully polished balls of rock crystal, amulets and other gems, which were apparently held to possess the power of exorcising evil spirits. Their use as talismans is indeed mentioned by a number of authors. They have also been found associated with the ashes of cremation. The old error of supposing rock crystal to be solidified moisture was held even as late as the 17th century, when popular treatises declared it to be nothing else than snow or ice congealed by time beyond the power of liquefaction. In the East, the superstition took a more grotesque form. The smaller crystals of pure quartz were believed by the Japanese to be the congealed breath of the White Dragon, and in its larger and more brilliant form to be the saliva of the Violet Dragon. Rock crystal was formerly known as *clear ice*, the one expression serving for both substances. The Chinese and Japanese word *suisho* reflects the same idea, as it means "substance of water."

JAPANESE METHOD OF GRINDING CRYSTAL BALLS.

The occurrence of rock crystal in nature is almost unlimited, but the more beautiful crystals, so highly prized in the fine arts, are sufficiently rare to be ranked among the precious stones. There are a number of famous localities scattered throughout Europe, particularly in the Tyrol and in Germany. Fine, clear crystals are found by the inhabitants of Chamouny, in the neighborhood of Mount Blanc. A remarkable cave in the granite at Galenstock yielded over 1,000 crystals, weighing from 50 to 300 pounds each, and of a rich smoky color. The finest of this group is in the Bement collection, at Philadelphia. It is known as the *President*, and weighs 125 pounds. Another notable quartz crystal, found in a drusy cavity at Zirkenstock, weighed 800 pounds. These, however, were remarkable finds, and will probably never be duplicated.

GRINDING CRYSTAL BALLS IN THE OBERSTEIN DISTRICT, GERMANY.

The material for the crystal-cutting industry in Japan is found in large, clear masses in the mountains on the islands of Niphon and Fusiayma and in the granitic rocks of Central Japan. In the entire empire, nineteen mines are worked for this mineral. Transparent masses that would furnish perfect spheres six inches in diameter have also been found among the gravel beds. It is supposed however that much of the Japanese material really comes from China, and possibly from Corea. The Corean embassy that recently visited America stated to Mr. Kunz that there were twelve crystal workers in that country.

The Japanese methods of working rock crystal are extremely simple, and depend more upon the skill and patience of the workers than upon the tools at their command. Our illustration shows the process of manufacturing crystal balls. It is taken from a sketch recently made by an Oriental traveler. The rough mass of crystal is gradually rounded by careful chipping with a small steel hammer. With this tool alone a perfect sphere is formed. The Japanese workmen thoroughly understand the fracture of the mineral, and know just when to apply chipping and when hammering. The crystal, having been reduced to a spherical form, is handed to a grinder, whose tools consist of cylindrical pieces of cast iron, about a foot in length, and full of perforations. These cylinders are of different curvatures, according to the size of the crystal to be ground. Powdered emery and garnet are used for this first polishing. Plenty of water is supplied during the process, and the balls are kept constantly turning, in order to secure a true spherical surface. Sometimes they are fixed in the end of bamboo tubes, and kept dexterously whirling in the hand until smooth. The final polishing is effected with crocus or rouge (finely divided hematite), giving a splendid lustrous surface. As hand labor is exclusively used, the manufacture of crystal objects, according to the Japanese methods, is extremely laborious and slow. Were it not for the cheapness of labor in the Mikado's country, the method would be commercially impracticable.

LARGE JAPANESE CRYSTAL BALL BELONGING TO MR. R. E. MOORE.

In Germany, France, and the United States, where labor is so much better paid, the fabrication of rock crystal is accomplished almost entirely by machinery. The crystal to be shaped into a ball is placed against a semicircular groove worn in huge grindstones. Our illustration shows the method practiced at Oberstein. The workman has his feet firmly braced against a support, and, resting upon his chest, presses the crystal against the revolving grindstone. It is unnecessary to add that the position is extremely unwholesome, and develops early consumption. A constant stream of water is kept flowing over the stone, so that the crystal shall always be moist, as the friction would otherwise heat it, and the subsequent addition of water would be liable to cause a fracture.

The final polishing is done on a wooden wheel with tripoli or a leather buffer with tripoli or rouge.

Of the many forms of manufactured rock crystal, the sphere has always been a favorite. One of the largest and most perfect ones known is in the Dresden Green Vaults. It weighs 15 German pounds, and is 6·69 inches in diameter. It was undoubtedly used for purposes of augury. The finest ball in this country is that in the possession of Mr. R. E. Moore. It is 6·625 inches in diameter, and is valued at $5,000. It was made in Japan, and is a *tama*, or jewel ball, absolutely pure. The stand is of Indian workmanship. Another ball in the possession of the same collector, though much smaller, is of interest as an excellent example of the Japanese fondness for representing crystal balls borne aloft by the waves. The stand is of bronze, and an admirable imitation of a succession of waves. The largest ball, 2·5 inches in diameter, rests on the crest, while three smaller balls, all under an inch in diameter, are distributed about the base. A 4·5 inch ball, of exceeding purity, was sold in the Morgan collection last winter for $1,750. It was mounted on a silver stand, ornamented with a golden dragon and other figures, and containing the private or palace seal of the Mikado. The stand alone was estimated to be worth $800. There are a number of other crystal balls in this country which are worthy of mention. Mr. Samuel Nickerson, of Chicago, has one measuring 5·625 inches in diameter, which was brought from Japan by Commodore Perry. It is valued at $2,500. Mr. Brayton Ives has one of the same size valued at $3,000. A ball in the possession of Mr. Heber Bishop has a diameter of 5·875 inches, and Mr. Walters, of Baltimore, owns another 5·75 in. in diameter.

JAPANESE CRYSTAL BALLS ON BRONZE STAND REPRESENTING WAVES.

The high prices of crystal balls are not due to the cost of fabrication, as is commonly supposed, but simply to the extreme rarity of masses of rock crystal which will afford absolutely pure spheres from 3·5 inches in diameter upward. The constant demand for these beautiful objects, which has at all times been greater than the supply, warrants the belief that their value is increasing, and that in years to come they will be even more difficult to obtain than at present. The numerous valuable cabinets in this country cannot boast the possession of half a dozen perfect crystal balls over five inches in diameter. It is undoubtedly the material, and not the skill, that is lacking. Thus, for instance, the facilities for working hard minerals in the Oberstein district in Germany are so excellent that a dish of agate, 13 inches long, 8 wide, and over 3 deep, which had been reduced to one-eighth of an inch in thickness, sold in New York for $200, in spite of duty and the profits of three dealers. In the United States the facilities for crystal cutting are also excellent, but large masses of the material are rare. There are now three parties who have machinery such as is used in the Oberstein district, and who are prepared to manufacture perfect crystal balls at the following prices: 1 inch, $1; 2 inches, $5 to $8; 3 inches, $15 to $25; 4 inches, $40 to $75; 5 inches, $125 to $150; 6 inches, $200 to $300; 7 inches, $300 to $400; and intermediate sizes in proportion.

RUSSIAN CRYSTAL VASE.

Even dealers themselves are frequently ignorant of what constitutes the expense of crystal balls, and state that it is the labor and skill required in their cutting, instead of the rarity of the material employed. Mr. Kunz has had occasion to visit almost all the public and private collections in this country, and to write hundreds of letters of inquiry on the subject of American gems and gem minerals, yet he failed to learn of any masses of rock crystal in the United States that would produce a perfect three inch ball.

There were several pieces that would have afforded balls from three to four inches in diameter, but they were so filled with veinings that the material was used for other purposes. The rarity of large masses of pure crystal is such that a well-known dealer has a standing offer open of $1,000 for a five inch crystal ball, $1,500 for one of five and a half inches, and $4,000 for a seven inch ball.

CRYSTAL VIAL, SHOWING ACICULAR CRYSTALS OF HORNBLENDE. (FULL SIZE.)

Messrs. Tiffany & Co. have very recently come into possession of a magnificent mass of rock crystal which will probably afford the material for a five inch ball. It comes from a new American locality, and is apparently without blemish.

Among the imperfections which unfit so much of the rock crystal for the purpose of manufacture are seams, inclusions of other minerals, and cavities filled with liquid. In addition to these there is the bulb of concussion, as it is termed, produced when a mass of crys-

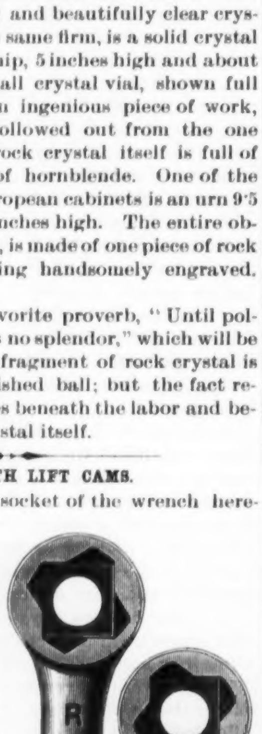
tal receives a sharp blow. These may be seen in any agate mortar which has been extensively used in the laboratory. A perfect funnel-shaped flaw is produced, and is apt to become further developed if an attempt is made to work the crystal.

Viewed as works of art, however, the cups, vases, and pitchers of crystal made during the 16th and 17th centuries at the Louvre, Dresden Green Vaults, and Shatz-Kammer at Vienna, are immensely superior to the simple crystal balls. Two pieces of this class, recent Viennese reproductions, were formerly in the Morgan collection. They are in the shape of dishes, and measure from 4 to 6 inches across. They are beautifully engraved in intaglio, and mounted in silver and gems. One of the most notable of these objects in the United States is now in possession of Messrs. Tiffany & Co. It is a circular disk of 9⅞ inches in diameter, on which the Finding of Moses has been beautifully cut in intaglio. Shortly after its completion, this remarkable piece of crystal was unfortunately dropped by the engraver, and is now in two pieces, but even in its mutilated condition it is an admirable work of art. Another piece of good carving and beautifully clear crystal, in the possession of the same firm, is a solid crystal vase of Russian workmanship, 5 inches high and about 3·25 inches broad. The small crystal vial, shown full size in our illustration, is an ingenious piece of work, both balls having been hollowed out from the one opening in the end. The rock crystal itself is full of delicate acicular crystals of hornblende. One of the finest pieces of work in European cabinets is an urn 9·5 inches in diameter and 9 inches high. The entire object, including the pedestal, is made of one piece of rock crystal, the upper part being handsomely engraved. Its cost was about $20,000.

The Japanese have a favorite proverb, "Until polished, the precious gem has no splendor," which will be appreciated when a rough fragment of rock crystal is compared with a finely polished ball; but the fact remains that its real value lies beneath the labor and beneath the polish, in the crystal itself.

A WRENCH WITH LIFT CAMS.

The opposite sides of the socket of the wrench herewith illustrated are formed with cams to act against a nut to lift the wrench between successive turns, thus making a tool which can be used conveniently in place of a ratchet wrench. The square corners or faces which abut against the nut to turn it in one direction are adapted for making a right hand turn on one side of the tool, while the other side has these square corners adapted for making a left hand turn, the withdrawing or backward movement of the wrench being in each case aided by the cams at the corners of the socket adjacent to each angular face that bites on the nut. With this wrench it is only required to move the hand back and forth, as the cams lift the wrench to the top of the nut upon the back stroke, and gravity causes it to drop again over the nut. This invention has been patented by Mr. Alfred Wood, of Trenton, N. J.

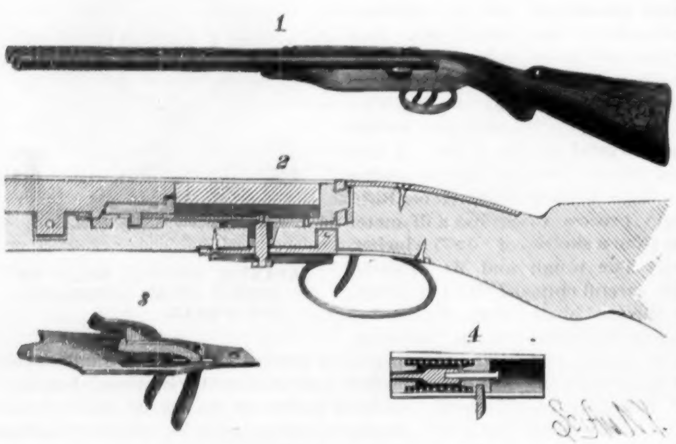


WOOD'S RIGHT AND LEFT WRENCH.

ONE pound nitrate of ammonia to two or three pounds water is the best of the simple mixtures for producing cold.

A HAMMERLESS BREECH-LOADING GUN.

In the illustration herewith are shown a perspective view (Fig. 1) and details of an improved construction of breech-loading gun in which the hammers are concealed, Fig. 2 giving the longitudinal vertical section, Fig. 3 the trigger plate and triggers, and Fig. 4 a section of one of the lock chambers. The barrels are connected in the usual manner, and have near their breech ends a downwardly projecting tongue, which is secured in a recess in the stock by a pin, the breech ends of the barrels thus resting upon the forward end of the lock and barrel seat. The side of one of the barrels has a long cylindrical eye, through which passes a long pintle, a tube secured to the side of one of the lock casings turning upon the pintle, and there being a twisted slot in the tube in which works a pin, by which, when the lock casings rest in their seat, the lip of the extractor will rest in notches in the breech ends of the barrels, but when the lock casings are swung out to the side, the pin will be forced rearward, drawing the arm and extractor rearward with it, throwing out the empty shells from the breech ends of the barrel. The lock casings are tubular, and have longitudinal slots in their under sides, pins or sears projecting from the sliding hammer blocks through the slots in the lock casing, and sliding therein. The forward ends of the triggers have beveled upwardly projecting lips, so that the lower beveled ends of the sears may be drawn over the lips and engaged by the same, the forward ends of the triggers having springs forward of their fulcra which force the lips of the triggers upward.



JANSEN'S BREECH-LOADING GUN.

Our illustrations show the invention as applied to a double-barreled gun, but the mechanism may as well be employed in a single-barreled fire arm, the principle remaining the same, or portions of the mechanism may be used with portions of other similar mechanism.

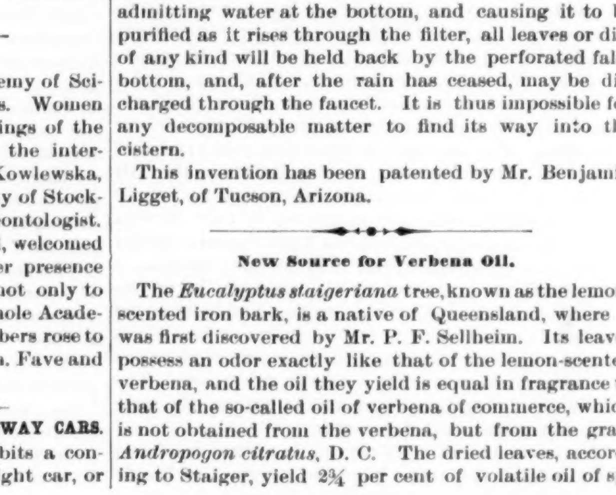
This invention has been patented by Mr. Diederich W. Jansen, of Joplin, Mo.

A Scientific Woman.

A regulation as old as the French Academy of Sciences has just been broken through in Paris. Women have hitherto been excluded from the sittings of the Academy, but at the meeting of June 28 the interdiction was raised in favor of Mlle. Sophie Kowlewska, professor of mathematics at the University of Stockholm, and daughter of the eminent paleontologist. Admiral Jurien de la Graviere, who presided, welcomed her in graceful terms, and said that her presence should be a cause of pride and pleasure, not only to the mathematicians present, but to the whole Academy. As she entered, the whole of the members rose to salute her. She took her place between Gen. Fave and M. Chevreul.

DEVICE FOR CONTROLLING LOCKS ON RAILWAY CARS.

The invention herewith illustrated exhibits a construction by which a railroad express or freight car, or any part thereof, or a safe in the car, may be locked so as to prevent admission thereto while the car is in transit, or only at certain places on the journey, the locking and unlocking mechanism being such as can be set for the distance to be traveled, and not affected by the time taken for the journey. Upon one of the axles is an eccentric, which operates a bell crank connected with a lever in the interior of the car, from which motion is taken to actuate a train of gears forming the running or bolt-controlling mechanism of the lock. A means of regulating the motion of the bolt-controlling mechanism is afforded by making the lever connected with the bell crank with a series of holes at different distances from its fulcrum, with any one of which the rod may be engaged to make the motion faster or slower. The bolt-controlling tumbler, too, may be adjustable, or be provided with a number of slots to provide for the drawing back of the bolt at fixed distances apart on the route. This invention has been patented by Messrs. Roman L. Baca and John L. Leavitt, of Grant, New Mexico.



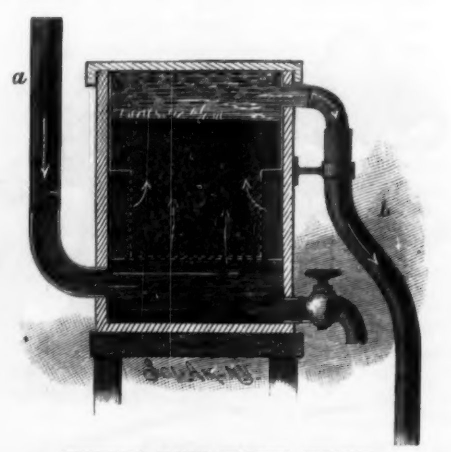
BACA & LEAVITT'S RAILWAY CAR LOCK.

How to Separate the Layers of Insect Wings.

A wing that has never been dried is placed in 70 per cent alcohol, then into absolute alcohol, and after a few days' immersion then placed into turpentine. After remaining a day or two in the turpentine, the specimen is plunged suddenly in hot water, when the conversion of the turpentine into vapor between the two layers of the wing so far separates these layers that they can be easily parted and mounted in the usual way, as microscopical preparations on a slide.—*Royal Microscopical Journal.*

RAIN WATER FILTER.

The simple and inexpensive filter herewith illustrated is designed to purify the rain water flowing from the roof, and conduct it to a cistern. The water from the roof flows through the pipe, *a*, from the leader into a compartment in the lower part of the tank. The first water, which has washed the roof, is allowed to flow through the faucet and go to waste. When the water is comparatively clear, the faucet is closed, when the water flows upward through a false bottom supporting the filter proper, which is made smaller at its lower portion than at its top, and which snugly fits the tank, a packing making it watertight against the sides, to compel the water to pass through the perforated sides and bottom into the interior, which is filled with sand, charcoal, or some other suitable material. The water then flows through the pipe, *b*, to a cistern or reservoir. It is evident that by admitting water at the bottom, and causing it to be purified as it rises through the filter, all leaves or dirt of any kind will be held back by the perforated false bottom, and, after the rain has ceased, may be discharged through the faucet. It is thus impossible for any decomposable matter to find its way into the cistern.



LIGGET'S RAIN WATER FILTER.

This invention has been patented by Mr. Benjamin Ligget, of Tucson, Arizona.

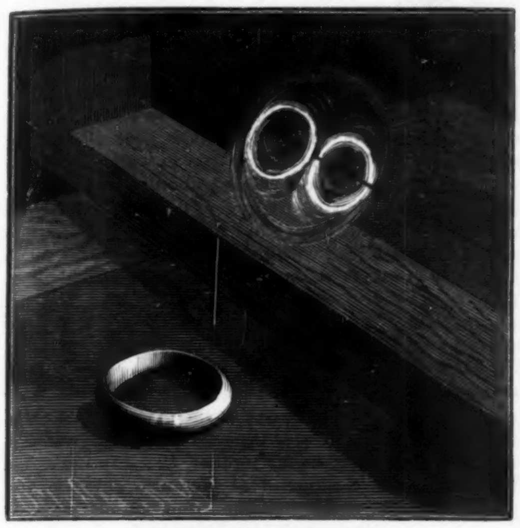
New Source for Verbena Oil.

The *Eucalyptus staigeriana* tree, known as the lemon-scented iron bark, is a native of Queensland, where it was first discovered by Mr. P. F. Sellheim. Its leaves possess an odor exactly like that of the lemon-scented verbena, and the oil they yield is equal in fragrance to that of the so-called oil of verbena of commerce, which is not obtained from the verbena, but from the grass *Andropogon citratus*, D. C. The dried leaves, according to Staiger, yield 2¾ per cent of volatile oil of sp. gr. 0·901. The demand for the lemon grass oil is considerable, as much as 13,515 oz. having been exported from Ceylon in 1875; it is also largely manufactured at Singapore. Hence this tree, the *Eucalyptus s.*, appears worthy the attention of planters on account of its volatile oil. The odor of the oil is quite different from that of *Eucalyptus citriodora*, which resembles and might be substituted for citronelle oil, so extensively used for scenting soap.—*New Commercial Plants and Drugs, Thos. Christy.*

EXPERIMENTS IN SOUND.

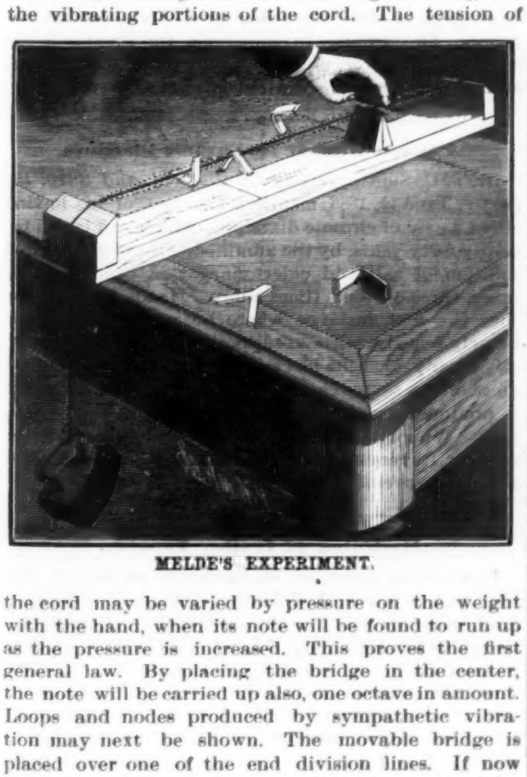
T. O'CONOR SLOANE, PH.D.

Few experiments are more interesting than those relating to sound. Although they involve some of the most delicate measurements and intricate calculations of science, yet much can be shown with the simplest form of apparatus. One of the commonest sources of musical sound is a vibrating cord. When an elastic filament is stretched between two points, and its center is drawn aside and suddenly released, it springs back under the influence of its inherent elasticity. In so doing it passes its point of rest, and swings to the other side, and returns, and thus, pendulum fashion, oscillates rapidly through the air, producing sound waves. The moving agent is the elasticity of the wire; the resistance to be overcome is the inertia of the air and of the material composing the cord. As the first and last named of these factors vary in efficiency, so will the number of vibrations. By tightening the cord, its acting elasticity is increased and the vibrations quickened. By loosening it, the reverse effect is produced. On loading it, by winding another cord or wire tightly around it, its inertia is increased, and the vibrations are made less frequent. By shortening it, it vibrates faster.



EXPERIMENT WITH RING.

A convenient apparatus for stretching a cord is needed for experimental purposes, and such in its simplest form is shown in the cuts. It is a board with stationary bridges secured at each of its ends, over which a wire is stretched by a heavy weight. As a rule, the heavier the weight, the better. It is well, for security, to fasten down the unweighted end of the board. This constitutes a simplified monochord, or sonometer. Its base is divided by pencil lines into integral parts; thirds and fourths are shown in the drawings. A movable bridge very slightly higher than the end bridges is used to change the length of the vibrating portions of the cord. The tension of the cord may be varied by pressure on the weight with the hand, when its note will be found to run up as the pressure is increased. This proves the first general law. By placing the bridge in the center, the note will be carried up also, one octave in amount. Loops and nodes produced by sympathetic vibration may next be shown. The movable bridge is placed over one of the end division lines. If now the short portion of the string is made to sound, by a violin bow or by the finger, the rest of the cord will be thrown into sympathetic vibration. It will sound the same note. To do this it must divide itself up into vibrating portions, each of the length of the part sounded. If the bridge is placed at the ⅓ mark, the remaining two-thirds of the cord will divide, and vibrate in two parts. Hence at the next ⅓ mark the cord will be at rest. This point is called a node, and it determines two loops of vibration, one on each side. Paper riders, cut out of light cardboard, or, what is inferior, made of paper folded and bent transversely, are placed on the cord. One rests over the ⅓ mark, and the other two are placed in the center of the loops. Now, on sounding the short portion of the cord, the middle rider is but slightly shaken, while the others are thrown off. By placing the bridge at the ¼ mark, three loops and two nodes will form, and can be proved to exist in the same way, five riders being used, of which three will be thrown off.



MELDE'S EXPERIMENT.

This proves the formation of loops and nodes. The next thing is to show them. A thread, white, and preferably of silk, is tied to the center of the cord. The other end is carried through the eye of a key, and weighted lightly, with a button or smaller key. The thread should be from four to six feet in length. Then, on sounding the cord, if all adjustments are right, the thread will be thrown into a series of beautiful loops and nodes, that can be seen with perfect distinctness, and which illustrate clearly the experiment with the riders. This is a simple version of a very famous experiment, due to Melde originally. It is usually executed with a tuning fork, and for anything on a large scale requires a diapason twelve inches long or more. The advantage of this method as a simplification is obvious. By varying the weighting of the thread, most peculiar and varied effects can be produced. A single node may be several feet long or only a few inches, the tightening or loosening of the thread producing the change.

A ring may be strung upon the cord, and the latter vibrated, when, if the ring is light enough, it will be thrown into very rapid rotation. If heavy, it may need to be started by hand, and then the cord may be vibrated. A curtain ring is of good size. It will whirl around with great rapidity, producing a very pretty effect. It operates also to prevent the cord vibrating. A light ring will rotate for a considerable period, but it will immediately stop the vibrations of the cord. Thus, after pulling or sounding the cord, a finger may be placed on it. It will be found that it is at rest, but the ring will continue rotating by its own mechanical energy. A rider may be used to show the quick cessation of vibration.

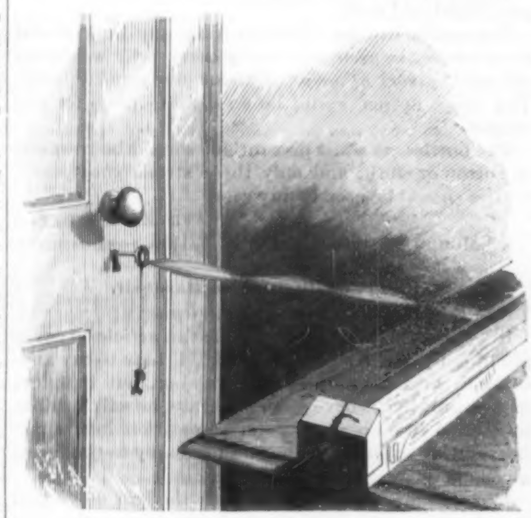
If the experimenter has a good ear, he may, even with the simple apparatus shown, go further. Thus, by shortening the string, the change of length corresponding to changes in pitch may be determined. The weights may also be doubled and quadrupled, in each case raising the note one octave, or doubling the number of its vibrations. Where a louder sound is desirable, the sonometer should be constructed of a long box, and be fitted with a thin sounding board of pine wood. More divisions may be used, so as to get any number of loops and nodes. The length may vary from two feet upward. For a vibrating cord, nothing is as good as steel wire, that may be of various sizes. A No. 16 wire should be stretched with fifteen pounds or more. For Melde's experiment, a heavy and elastic wire is requisite. Catgut is very troublesome, because of its tendency to untwist. For sounding, a violoncello bow is best, though the hand will answer.

The same experiments can be done on the large scale with a cord or wire fifteen or twenty feet long. It can be stretched across a room, and loops determined by holding it between the finger and thumb at some point of integral division. For this work, a drum snare is very good. The great point is to subject the cord to a heavy strain. Unless the cord is very tight, the experiments will fail oftener than succeed.

In the last issue of this journal, a simple whirling apparatus was described. As a matter of interest, an approximate determination of its velocity of rotation has been made, with the result that a speed of 600 to 1,000 revolutions a minute can be attained. This is ample speed for almost all experiments, and is too high for most.

Belting Experiments.

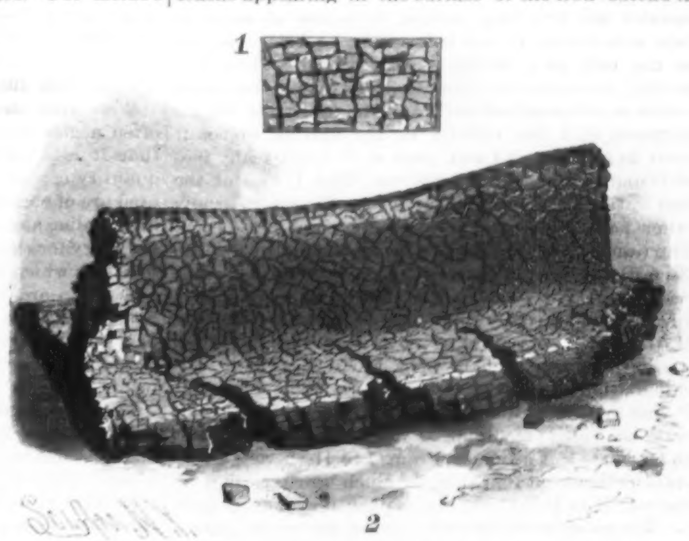
At the recent meeting of the American Society of Mechanical Engineers in Chicago, a paper was read by Mr. Wilfred Lewis, of Philadelphia, on "Experiments on the Transmission of Power by Belting." Among the conclusions reached from these experiments are the following: That the coefficient of friction may vary under practical working conditions from 25 per cent to 100 per cent; that its value depends upon the nature and condition of the leather, the velocity of sliding, temperature and pressure; that an excessive amount of slip has a tendency to become greater and greater, until the belt finally leaves the pulley; that a belt will seldom remain upon a pulley when the slip exceeds 20 per cent; that excessive slipping dries out the leather, and leads toward the condition of minimum adhesion; that raw hide has a greater adhesion than tanned leather, giving a coefficient of 100 per cent at the moderate slip of 5 feet per minute; that a velocity of sliding equal to 0·01 of the belt speed is not excessive; that the coefficients in general use are rather below the average results obtained; that the sum of the tensions is not constant, but increases with the load to the maximum extent of about 33 per cent with vertical belts and indefinitely with horizontal belts; that as the economy of belt transmission depends principally upon journal friction and slip, it is important to make the belt speed as high as possible within the limits of 5,000 feet or 6,000 feet per minute; that quarter twist belts should be avoided; that it is preferable in all cases, from considerations of economy in wear on belt and power consumed, to use an intermediate guide pulley, so placed that the belt may run in either direction, and that the introduction of guide and carrying pulleys adds to the internal resistances an amount proportional to the friction of their journals.



LOOPS AND NODES.

DISINTEGRATION OF CAST IRON BY COAL GAS FLAME.

The engraving faithfully represents a portion of a flanged beam of cast iron recently taken from a boiler furnace in this city. The beam has never been in contact with the coals, but has been licked by the flames for about two and a half years. The cracks appearing in the surface of the iron extend in every direction throughout the mass. The character of the iron has been changed from that of the crystalline structure of ordinary soft gray iron to an apparently non-crystalline mass, to which has been given the appearance of crystallization by the cracks.



THE EFFECTS OF BURNING COAL GAS ON CAST IRON.

In some portions of the surface of the iron, the cracks give it the appearance of the bark of a tree, as shown in detail in the smaller figure.

The iron appears to be thoroughly carbonized, and is so hard as to completely resist the action of a file. The bar in its present state has scarcely strength enough to hold itself together. These facts seem to clearly indicate that unprotected cast iron is unfit for application to any portion of a boiler furnace exposed to the action of the burning coal gas.

Correspondence.

Home-made Indian Clubs Very Cheap.

To the Editor of the Scientific American:

The following inexpensive substitutes for Indian clubs will be appreciated by those who have not had the advantages of a good gymnasium open to them.

Take a couple of these dark green ale bottles, clean and dry well. Then put in each enough dry sand to make required weight, either 2, 3, 4, or 5 pounds, as required. Now fill the remaining space with sawdust, pack tight and cork.

The bottles can be obtained from any junk dealer for a few cents each, and the grocery will weigh out the sand (silver), at a cost of about five cents a quart. Ten cents apiece would be an outside price for the largest.

The bottles, as a last precaution, should be wrapped in cotton or cloth, and only these strong *champagne* bottles should be used in any case.

AUDLEY H. STOW.

435 Mount St., Baltimore, Aug. 1, 1886.

The Art of Pitching in Baseball.

To the Editor of the Scientific American:

In your issue of this date I notice an article on curve pitching by Mr. Henry Chadwick. I hate to say anything to knock a man's pet theory out, but if Mr. C. will consult his "curve pitcher" again, he will, I think, be assured that his arrows show a rotation in a direction exactly opposite to the one necessary to produce a given curve.

E. g., in his diagram, cut A, with the ball moving in the direction BC, and rotating as shown, the ball curves to the pitcher's left, or is an *out* curve to a right-handed batter, and can be produced as in cut C, as stated. The opposite rotation is an "in," as in cut B. Any pitcher that ever "watched the ball" will, I know, agree with me. In cut D, the rotations should be changed around. I held up his theory myself until I found it conflicted with the facts of the case.

The side of the ball most retarded by atmospheric friction is invariably the side that goes *farthest*, and this is done as well when the axis of rotation is *parallel* to the ground, as it must be in the rise and drop balls nowadays so effective in keeping the base hit column low.

BALL PLAYER.

Ann Arbor, July 31, 1886.

The Art of Pitching in Baseball.

To the Editor of the Scientific American:

In the article on the "Art of Pitching in Baseball," SCIENTIFIC AMERICAN for July 31, Mr. Chadwick misstates the case. The rotation of the ball is, no doubt, the cause of its curving. But, as an *actual fact*, it does not curve as stated by him. "If," he says, "the ball (cut A) (or, strictly, its center of gravity) is moving forward (let us say at the rate of 100 ft. per second), and at the same time it is revolving so that points on its equator are traveling around its center at an equal rate, it is evident that D is traveling *backward* as fast as the ball, as a whole, moves forward; while I is moving forward at its own rate, *plus* that of the center—that is, twice as fast as E. As the friction of the air increases with the velocity of the moving object, it must be greatest at I and least at D, being really zero at D under the conditions given. The I side of the ball is, therefore, retarded more than the center or any other part, while the D side suffers no retardation. The result must be a curve *toward* the retarded side." Now, Mr. Editor, it is an *actual fact* that the curve is *from* the retarded side *to* the side of least resistance. In cut A, the curve is from I to H, and *not* from D to H, the pitcher standing at B, as stated by Mr. Chadwick; therefore, his deductions are not correct. His explanation of cut A is correct. The air is densest at P, and gradually decreases in density to H, where it may be called medium. From there it decreases to D, where it is normal. From I to H there is a constant pressure on that side so much greater than on the side H to D that the ball is pushed over away from I. The rotation of the ball is piling up—so to speak—the air at P, and causing a pressure there. This column of air or resistance is in the shape of a wedge of air, and forces the ball away from it. If you throw a ball over the surface of water, it will *richochet*, the water being denser. So the rotation of the ball makes a denser medium, and the ball leaves it, and as it is producing it all the time, the movement is continuous. Mr. Chadwick's description of how the rotation of the ball is accomplished is about correct. I would state I have made these curves myself, and did not find it a difficult matter.

A. G. EASTON.

St. Louis, July 30, 1886.

The Niagara Suspension Bridge.

The stone composing the four towers of the Niagara Railroad Suspension Bridge having been found to be slowly disintegrating, it has been decided to replace them by iron supports. Although a difficult and possibly dangerous undertaking, the work is being carried on without much interference with the use of the bridge. Every precaution has been taken to prevent accident. The workmen are now engaged in removing stone from the sides of the towers, in order to make room for the preliminary ironwork. The upper caps are being drilled, so that when the time comes, the hydraulic jacks may be readily slipped into place and the great cables transferred from the stone supports to the strong iron towers which are to replace them. These are being manufactured in Detroit, and will shortly be shipped to Niagara. Their cost will be $40,000.

PHOTOGRAPHIC NOTES.

Labeling Bottles.—In a paper read by C. H. Bothamley before the Leeds Photographic Society, embracing several useful subjects, we take the following concerning labels for bottles as published in the *Photographic News:*

In order to render paper labels durable, the name, etc., should be written with Chinese ink, and the label, after fixing, sized twice with a solution of gelatine or good glue. It should then have two coats of copal varnish. Labels treated in this way will last for years. If a label is required which can be read by transmitted light, nothing is simpler or more efficient than ordinary black varnish, which can be applied with a pen or camel's hair brush. After some time, the varnish may show a tendency to chip off; but it can easily be renewed. For bottles containing acids or caustic alkalies, the varnish is in all cases much better than paper labels.

Preparing Solutions.—When making up solutions of definite strength, it is important to remember that the volume of the solution is greater than the volume of the water used, but less than the sum of the volumes of the solid and the solvent before solution; for example, to dissolve one ounce of ammonium bromide in ten ounces of water does not make a ten per cent solution, because the volume of the solution is greater than ten ounces. In order to obtain a real ten per cent solution—*i. e.*, a solution which contains one part by weight of the salt in ten parts by measure of the solution—the one ounce of ammonium bromide should be dissolved in five or six ounces of water, and the volume of the solution then made up to ten ounces by adding more water. Similarly, a twenty per cent solution of hypo is made by dissolving twenty ounces of hypo in forty to fifty ounces of water, and then making the total volume up to 100 ounces.

Considerable time may be saved, and the operation of making up solutions much simplified, by determining, once for all, the capacities of the bottles in which the solutions are kept, and marking, by means of a writing diamond or black varnish, or in some other way, the point to which a bottle must be filled in order that it may contain 5, 10, 20, or 100 ounces, as the case may be. This is done, of course, by pouring the measure volume of water into the bottle, and marking the height at which it stands. Suppose, for instance, we have a bottle which holds 10 ounces of a 10 per cent solution of ammonium bromide, and it is required to make up a fresh quantity of solution. All that is necessary is to weigh out one ounce of the salt, transfer it to the bottle, add some water, and, when the salt is completely dissolved, fill up the bottle to the mark.

Recovering Residues.—The recovery of residues is often neglected, especially by amateurs, from a belief that it is a very troublesome matter; but if a large quantity of work is done, and especially if the plates used are of considerable size, the residues will be of no little value, and as a matter of fact the operations necessary for their recovery are very simple. The only solutions which any but workers on the largest scale need keep are the fixing bath from the plates, the fixing bath from the silver prints, and the first washings from the prints. In addition to these, there will be the clippings from the silver paper, and any waste prints.

The silver solutions may be all mixed together, and the silver precipitated in the form of sulphide by adding a solution of sodium sulphide. The sulphide is a dense black precipitate insoluble in hypo, and settles somewhat rapidly. When the precipitate has settled, the clear liquid may be drawn or poured off, and a fresh quantity of the silver solutions put into the same vessel and treated in the same way. When a sufficient quantity of silver sulphide has accumulated, it is dried, heated strongly, and then fused in a clay crucible with five or six times its weight of a dry mixture of sodium carbonate and borax, when a regulus of metallic silver is obtained; or the dried precipitate may be sent to the assayer.

Removal of Films from Plates.—The removal of old films from gelatine plates is most easily effected by soaking the plates in a mixture of 1 part commercial hydrochloric acid and 50 parts of water. In a short time the film will frill off the plate.

Stoppers for Varnish Bottles.—Every experienced photographer knows the troubles which arise from the use of corks in varnish bottles. The cork becomes cemented to the neck, and either breaks in the process of removal, or leaves small fragments of cork adhering to the inside of the neck, to say nothing of the fragments which fall into the varnish and render filtration necessary. Bottles with glass caps ground to fit can be purchased, but they are somewhat expensive; and, moreover, if a drop of varnish finds its way between the cap and the bottle, and is left there, it cements the two firmly together. The following plan will be found cheap and efficient: An ordinary bottle with a fairly long neck is taken, and a thick cylindrical ring of India rubber is slipped over the neck down to the junction of the neck with the bottle, care being taken that the India rubber projects beyond the well of the neck. A short wide test tube fits on the ring, and forms a cap to the bottle.

Intensifying Negatives.—Notwithstanding the various methods which have been proposed for intensifying gelatine negatives, mercurial intensification still holds its own, in spite of its defects. The removal of hypo, which is essential to success in this as in most other processes of intensification, is best effected by soaking the well washed negative in water to every 5 ounces of which has been added about 1 drachm of a 20 volume solution of hydrogen peroxide, as recommended by Abney. Next in efficiency to the peroxide comes alum acidified with hydrochloric or, better, citric acid. The plate is soaked in this for a considerable time, then washed, and allowed to dry with free exposure to air. The oxidizing action of the air during drying completes the work of the acidified alum, and converts the traces of hypo into non-reducing substances. Brown stains, however, sometimes make their appearance on negatives from which it is almost absolutely certain that every trace of hypo has been removed. According to Mr. Spiller, the staining is due to an insoluble compound of mercuric chloride and gelatine, and he states that the formation of this compound can be prevented by adding ⅛ drachm of concentrated hydrochloric acid to every 20 ounces of saturated mercuric chloride solution. It is not, however, advisable to use a saturated solution of mercuric chloride, as is generally recommended; a 2½ per cent solution acts more evenly, and is better under control. I find that much clearer and better results are obtained if the plate, after being taken from the mercury solution, and rinsed well with water, is placed for five to ten minutes in a 5 per cent solution of ammonium chloride. The use of this salt in the mercury solution has previously been recommended by England. Its effect is doubtless due to the partial solubility of the mercuric compounds in ammonium chloride. With regard to the relative merits of ammonia and sodium sulphite for the after treatment, it may be said that with the latter there is less risk of stains, but the intensification is not so great as with the former, since the metallic mercury reduced by the sulphite is not so opaque as the dimercuroso-ammonium chloride formed by the action of the ammonia. Theoretically, if the sulphite is used, it is possible, by a repetition of the process, to increase the intensification, and, in fact, to build up an image of metallic mercury. As a matter of practice, I find that the increased intensification which can be got in this way is only very slight. When ammonia is used, the strength of the solution does not exert any great influence on the result. The stronger the ammonia, the greater is the quantity of silver chloride removed from the film, and hence the intensification is somewhat weaker.

A Simple Remedy for Chronic Diarrhœa.

Dr. T. C. Smith, writing in the *Med. and Surg. Reporter*, June 12, 1886, mentions the fact of his having cured a case of chronic diarrhœa, which had lasted for nearly forty years, by the administration of a saturated solution of salt and cider vinegar, a drachm being taken three or four times a day. He also states that since the first instance where he recommended this homely remedy, without supposing that it would actually do any good, he has employed it several times in more or less severe cases of chronic diarrhœa, in which it produced great improvement, and, in some cases, cure. Where relapses followed the suspension of the remedy, its renewed administration was again followed by improvement.

Hastening of Leather Tanning.

In a process patented in Germany on Dec. 8, 1885 (Ger. pat. 36,015), J. S. Billwiller, of St. Gallen, Switzerland, proposes that the softened, unhaired, and purified skins be alternately treated with dilute solutions of sulphate of alumina and bicarbonate of soda. This operation must be frequently repeated. If, however, a solution of sulphate of alumina, as neutral as possible, be employed, more concentrated solutions can be employed, and it suffices then to adopt a single treatment with each solution. The hides thus swollen, and filled with aluminum hydrate, are then freed by a quick wash with dilute hydrochloric acid, and then with water, from the aluminum hydrate separated out on the surface. They are then tanned out in the tan solutions. Seeing that the hydrate of alumina combines with a portion of the tannin to form aluminum tannate, the tanning process is very greatly expedited.

ENGINEERING INVENTIONS.

A car door fastener has been patented by Mr. Henry C. Singiser, of Mechanicsburg, Pa. This invention covers a novel form of construction intended to do away with all loose swinging attachments heretofore carried by the car door, and serves to hold the door tightly closed irrespective of the jogging or jolting of the car.

A valve gear has been patented by Mr. Louis W. Bryan, of Quincy, Ill. It is an improvement especially designed for steam pumps, and the valves are so made as to be relieved from all pressure when they leave their seats, thereby balancing, so that only a slight spring is required to complete their stroke after being started.

A car coupling has been patented by Messrs. Thomas W. Talbot and J. Lucco Farmer, of Florence, S. C. It has two connected drawheads at right angles to each other upon trunnions, whereby either drawhead may be presented as desired, one of them being constructed as a throat, with coupling hooks and locking devices, and the other as a projection adapted to fit into the mouth of the opposite drawbar.

MISCELLANEOUS INVENTIONS.

A semaphore signal has been patented by Mr. William Thornburgh, of Elyria, O. This invention covers improvements on a former patented invention of the same inventor, with the object of simplifying the mechanism for working the signal wings in such a manner that they occupy less space.

An ash sifter has been patented by Mr. William T. Adams, of Baltimore, Md. It consists of a sifting cylinder in combination with a specially devised casing holding an ash box and a coal box, with various novel features, to promote convenience in construction and facility in use.

A horse collar has been patented by Mr. Robert M. Sears, of San Francisco, Cal. It consists in a soft, flexible collar, stiffened in the throat portion by a rigid curved bar, and having clips or hooks for receiving the hames, the collar being such as will readily adapt itself to the form of a horse's neck and shoulders.

A composition for holding photographic paper on its support, etc., has been patented by Mr. Thos. C. Roche, of Brooklyn, N. Y. It is a tacky composition for holding sensitive paper during exposure in the camera, and consists of rubber, beeswax, pitch, and a solvent, prepared in a manner specified.

A revolving sign has been patented by Mr. Alfred T. Fagerburg, of Bloomington, Ill. It has a supporting rod, with a head frame adapted to revolve on the rod, tappets on the frame, and bells pivoted to the rod with their stems in the path of the tappets, with other novel features, making a simple and inexpensive device for advertising purposes.

A life preserving float has been patented by Mr. Frank Vaughan, of Elizabeth City, N. C. It consists of a case made usually cylindrical in cross section and bent into ring shape to encircle the body, being divided by partitions into independent air tight compartments, while there are recesses on opposite sides for the arms of the wearer.

A feed cutter has been patented by Mr. Adolph Hamacek, of Ahnapee, Wis. In front of the feed box are longitudinally ribbed feed rollers, and beyond these a presser roller or plate and cutters, with various novel features of construction and arrangement of parts, to facilitate the cutting of hay, straw, and similar material.

A saw table has been patented by Mr. Herbert J. Thompson, of Ogema, Wis. Combined with a carriage is a slide, an arm on the slide, and a block on the end of the arm, the block being on a line with a ledge on the end of the slide, the device being adapted for cutting off the sapwood and cutting out the knots of shingles, and making the edges straight.

A medical operating couch has been patented by Mr. Frederick W. Uhde, of Philadelphia, Pa. It has revolving screw rods, operated by a crank, so connected with its frame as to afford a mechanism by which the couch may be raised and lowered horizontally, or adjusted on an incline, or it may be adapted to serve as an ordinary lounge.

A combined truss and abdominal support has been patented by Mr. James A. Tigner, of Rome, Ga. This invention consists in the special construction of the support and truss, which is made to be held in position by a single belt passed around the body, thus avoiding the discomfort and liability to displacement incident to strapping the truss to the limbs.

A cartridge loader has been patented by Mr. James V. Thompson, of Fort Madison, Iowa. The instrument is set upon a base plate, and consists of a standard with slotted upper end to receive the end of a lever arm, a plunger being connected to the lever, and the machine having a number of these plungers, varying in size to fit within shells of different calibers.

A dress protector has been patented by Jenny M. Haskell, of Greenwich, N. Y. It consists of a light, comfortable harness, of elastic and non-elastic straps, which can be readily applied to shields of thin waterproof material, shaped to fit next the skin, and protect garments from perspiration, to hold the shields in place and without discomfort to the wearer.

A spool holder has been patented by Mr. Benjamin F. Baker, of Fairville, New Brunswick, Canada. It consists of a wedge-shaped casing, with holders formed of spring wire, adapted to hold any desired number of spools of different lengths, the holder being in form convenient to hang up to unwind the thread for use in sewing.

A vapor fuel apparatus has been patented by Mr. Augustin I. Ambler, of Washington, D. C. This invention consists in novel constructions and combinations of parts, whereby the vaporizing of the petroleum or oil and mixture of the steam with it or its vapors is very perfectly and economically secured, the apparatus is readily controlled, and other advantages are obtained.

A baling press has been patented by Mr. George Ertel, of Quincy, Ill. It is a machine occupying very little ground space, and is adapted for the continuous formation of bales from below and their discharge from the top of the press, the present invention being an improvement on a former patent of the same inventor, intended to better the mechanism insuring the positive operation of the follower.

A fruit conveyer has been patented by Mr. Marshall N. Gaines, of Dunedin, Fla. Combined with a flexible conducting tube having a flaring mouth and a suitable handle is a series of cushioned valves working therein, and returnable by means of elastic or other spring device to a horizontal position, the device being applicable to all sizes of fruit, to discharge it upon the ground or in a suitable receiver.

NEW BOOKS AND PUBLICATIONS.

THE FIELD PRACTICE OF LAYING OUT CIRCULAR CURVES FOR RAILROADS. By John C. Trautwine, C.E. Twelfth Edition. New York: John Wiley & Sons, 1886.

Prepared originally by Mr. Trautwine in 1851 for the use of the younger members of the profession, the popularity and usefulness of this complete treatise on railroad curves has been amply demonstrated by the large sale it has reached and the frequent revision which time has made necessary. Since the death of the author, it has fallen to the son to prepare this last edition. The methods of laying out curves, of finding their radii, and of calculating the elevation of the outer rail are all treated very carefully and in full detail. The study of curves of more than 180° has also been included, since their utility has been made evident of late years in the difficult engineering required by the Rocky Mountain topography. The description of the engineer's transit and its adjustments will be found useful by those not thoroughly acquainted with the instrument. The tables of the trigonometrical functions are as perfectly reliable, we believe, as any published. The volume is attractively bound in leather, and will make a convenient pocket-book of reference.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) **T. H. S. asks what lightning proof** fencing is. It is spoken of in your issue of July 17, in an article on "A New Mountain Observatory." A. A wire or metallic fence, grounded at frequent intervals, and provided with numerous projecting points, is practically lightning proof, and within a distance depending on its height is lightning protective.

(2) **E. L. writes: I desire to make a** cheap pluviometer. I have a glass tube ⅝ of an inch in its short diameter, and do not know the proportionate scale to divide it, in order to mark the tenths, inches, etc., of rainfall; the tube is 30 inches long. A. To construct a rain gauge, simply close the lower end of your tube with a cork, covered as inserted with melted sealing wax. Then set it in an upright position away from houses, preferably on top of a post, and the direct reading will give you the rainfall. Or fit a tin funnel to its top, and divide it, making the divisions larger in the ratio of the squares of the diameters of the tube and funnel mouth. Thus, if the funnel is 3 inches, then magnify the divisions in the ratio of 3^2 to $⅝^2$ or as $9 : \frac{25}{64} = 576 : 25$ or 23 : 1 nearly.

(3) **A. M. asks (1) if cylinder 36 inches** long, 18 inches in diameter, ¼ inch thick, can be magnetized, the cylinder to be under water. A. It can by a sufficiently powerful current. 2. Would steel be better than iron to make the cylinder with? A. If to be magnetized permanently, it must be of steel. 3. Is the dynamo described in SUPPLEMENT, No. 161, strong enough to magnetize it? If not, what is the best way to magnetize and keep it magnetized? A. A much larger dynamo or fifty to one hundred good cells would be about right for magnetizing it.

(4) **R. H. B. writes: Please inform me** how extra porous carbon tubes are made for Jablochkoff's auto-accumulator, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 498. It says that they "are prepared from finely divided coke mixed with other material, which will be destroyed in the baking process, and leave the spaces occupied by it free to be penetrated by the atmosphere." What is the other material mixed with the coke, so as to leave the interstices? A. The materials used in cementing coke dust for battery carbons may be sugar sirup, coal tar, or other similar material. You will find strong sirup quite satisfactory, and cleaner to work with than tar.

(5) **H. P. S. asks: 1. How can the scraps** or shavings of the working of tortoise shell be utilized? A. We know of no means by which they can be used. 2. How are names put on tortoise shell with fine gold wire? A. Wire is heated and pressed in. 3. How are names printed placed in between the shell, and plainly legible from outside? A. The name is placed between thin plates of tortoise shell. 4. How can two pieces of shell be soldered together? I have seen new teeth put into a comb, and imperceptible; how is this done? A. Use a pair of pincers or tongs, constructed so as to reach 4 inches beyond the rivet; then have the tortoise shell filed clean to a lap joint, carefully observing that there is no grease about it; wet the joint with water, apply the pincers hot, following them with water, and the shell will be joined as if it were one piece. The heat must not be so great as to burn the shell, therefore try it first on a piece of white paper. 5. How to polish tortoise shell? A. Having scraped the work perfectly smooth and level, rub it with very fine sandpaper or Dutch rushes; repeat the rubbing with a bit of felt dipped in very finely powdered charcoal with water, and, lastly, with rottenstone or putty powder, and finish with a piece of soft wash leather, damped with a little sweet oil; or still better, rub it with subnitrate of bismuth by the palm of the hand. 6. How can you soften tortoise shell, besides soaking in hot water? A. Use diluted sulphuric acid; also see Spons' "Workshop Receipts."

(6) **W. S. N. asks: 1. Where could I get** recipes for nutritious summer drinks? A. See "Effervescent Beverages," containing recipes for ginger beer, lemon beer, hop beer, and spruce beer. 2. The manner of preparing, and what part of the fish is used in making fish glue or isinglass? A. See "Glue and Gelatine, Pastes, Mucilages," etc., by F. Davidowsky, which we can send you for $2.50.

(7) **W. . W. asks how to melt old rub**ber, such as old rubber car springs and scraps, so as to be able to run it into moulds for new work. A. Heat the India rubber with steam; the sulphur then discharges, the India rubber melts, runs into the hot water and collects at the bottom of the pot, while the vapor prevents it burning. The properties of the India rubber are thus sensibly modified; it becomes a blackish mass, liquid at the ordinary temperature, but drying in the air, and becoming then impervious to water. The material loses its elasticity, but is suitable for the preparation of gums or special varnishes for certain articles. It cannot, however, be run into moulds for new work as you suggest. See description of "India Rubber Manufacture," in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252.

(8) **W. H. C. desires a receipt for mak**ing genuine root beer. A. Take 1 oz. each of sassafras, allspice, yellow dock, and wintergreen, ½ oz. each of wild cherry bark and coriander, ¼ oz. hops, and 3 qts. molasses. Pour sufficient boiling water on the ingredients and let them stand 24 hours, filter the liquor, and add ½ pint yeast, and it is ready for use in 24 hours.

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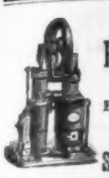

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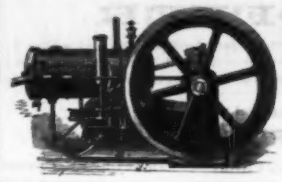

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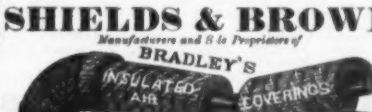

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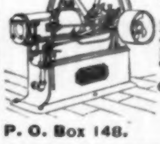

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